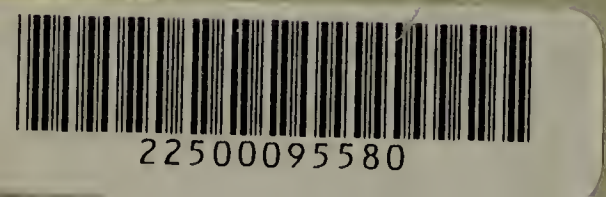




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SAJOUS'S
ANALYTICAL CYCLOPÆDIA
OF
PRACTICAL MEDICINE

BY
CHARLES E. de M. SAJOUS M.D.

AND
ONE HUNDRED ASSOCIATE EDITORS

ASSISTED BY
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VOLUME IV



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PREFACE.

The manner in which the members of the medical profession have received the previous volumes of the *ANNUAL AND ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE* has been so encouraging that it is with renewed pleasure that the editor places the fourth issue before his readers. The marked success implied has not only been due to the novel plan of the work,—a general article upon each disease, sustained by the salient points of the literature of the last ten years,—but also to the excellence of the general articles (presented in large type) written by the members of the associate staff. To all of these gentlemen the editor wishes, therefore, to renew his expressions of gratitude.

This volume contains an elaborate paper on “Malarial Fevers,” by Professor James C. Wilson and Dr. Thomas G. Ashton, which will also, it is hoped, receive the great appreciation to which it is entitled. The article on “Locomotor Ataxia,” by Dr. W. B. Pritchard, of New York; that on “Diseases of the Liver,” by Professor Alexander McPhedran, of Toronto; that on “Meningitis,” by Dr. Charles M. Hay, of Philadelphia, are also entitled to special notice as models of their kind. The editor must express his regret that through unavoidable circumstances he was obliged to write the article on “Leprosy” himself, and at the last moment. Still, the fact that he has had the opportunity of seeing quite a number of cases during his travels and the important rôle played by the upper respiratory tract in the etiology of the disease lead him to hope that he may have treated the subject with a certain degree of competence.

In the preface of the third volume special attention was drawn to an article by Dr. Blackader, of Montreal, on the “Diarrhœal Diseases of Infants.” In this volume will be found a complementary paper of very great value by Drs. L. Emmett Holt and L. E. La Fétra, of New York, entitled “Nursing and Artificial Feeding.” The mortality among infants during the summer months would be greatly reduced if the teachings of these papers were carefully studied and carried out.

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TABLE OF CONTENTS.

(Volume IV.)

	PAGE		PAGE
Abrastol	564	Cancer of Gall-bladder.....	230
Abrin Poisoning	64	Cancrum Oris	506
Abscess, Alveolar	58	Carcinoma of Lips.....	511
Abscess, Mediastinal	367	Cardiac Aneurism	539
Abscess of Breast.....	344	Catarrh, Chronic Post-nasal.....	608
Abscess of Liver.....	204	Catarrh, Dry or Fœtid.....	577
Abscess of Septum.....	586	Catarrhal Otitis Media.....	459
Abscess, Submammary	344	Catarrhal Rhinitis	566
Abscess, Subphrenic	198	Catarrhal Stomatitis	501
Adenoid Vegetations	592	Cerebral Meningitis	375
Æstivo-autumnal Fever	296	Cerebral Pachymeningitis	375
Albinism	5	Cerebro-spinal Meningitis, Epidemic.....	383
Alcoholic Neuritis	619	Cervico-brachial Neuralgia	644
Alveolar Abscess	58	Cervico-occipital Neuralgia	644
Amyloid Liver	224	Chapped Lips	510
Anæsthetic Leprosy	155	Charcot's Disease	79
Angiocholitis	227	Cholangitis	227
Aniridia	5	Cholecystitis	227
Ankylosis	91	Cholecystitis, Acute Infectious.....	231
Aphakia	151	Cholecystitis, Acute Phlegmonous.....	231
Apthous Fever	508	Choroid, Disorders of.....	5
Apthous Stomatitis	502	Choroiditis	13
Arsenical Neuritis	619	Ciliary Body, Disorders of.....	5
Arthritis	69	Coccygodynia	645
Arthritis of Gout.....	78	Colic Due to Intestinal Obstruction.....	708
Arthritis, Rheumatic	75	Colic, Lead	141
Artificial Feeding of Infants.....	682	Coloboma Lentis	150
Asaprol	564	Coloboma of Choroid.....	7
Atrophic Rhinitis	577	Coloboma of Iris.....	6
Atrophy of Liver, Acute Yellow.....	201	Compression of Intestines, Obstruction	
Aural Polypi	478	Due to	707
		Compression of Nerves.....	636
Bednar's Aphthæ	509	Concretions, Intestinal Obstruction Due	
Bell's Palsy	623	to	707
Bile-passages, Inflammation of.....	227	Congestion of the Liver.....	195
Biliary Tract, Tumors of.....	230	Contracture of Muscles.....	526
Black-water Fever	304	Contusions of Nails.....	558
Breast, Abscess of.....	344	Contusions of Nerves.....	634
Breast, Diseases of.....	339	Corectopia	6
Breast-milk	674	Cornea, Inflammation of.....	95
Bullous Keratitis	97	Corset Liver	193
		Coryza, Acute	566
Calomel (see Mercury).		Coryza of Infants, Simple Acute.....	568
Canaliculi, Anomalies of.....	113	Cows' Milk	683
Cancer of Biliary Tract.....	230	Cracked Lips	510

	PAGE		PAGE
Croupous Rhinitis	569	Hæmo-hepatogenous Jaundice	52
Croupous Stomatitis	508	Hæmorrhagic Internal Pachymeningitis..	377
Cyclitis	7	Heart, Injuries of.....	368
Cyst of Liver, Hydatid.....	220	Hepatic Abscess	204
Cysts of Iris.....	17	Hepatogenous Jaundice	44
		Hérnia of Muscles.....	524
Dacryoadenitis	112	Herpes Zoster of Mouth.....	509
Dacryocystitis	115	Herpetic Keratitis	97
Dacryops	113	Hydatid Cyst of the Liver.....	220
Dendritic Keratitis	97	Hypertrophy, Muscular	519
Deviations of Septum.....	587	Hypertrophy of Nails.....	559
Dislocation, Muscular	524		
Displacements of Liver.....	194	Icterus (see Jaundice).	
Dry Catarrh	577	Icterus Neonatorum	54
Dura Mater, Hæmatoma of.....	377	Ileus	703
		Infant-feeding	674
Ear, Middle	458	Infectious Myositis	517
Ectopia Lentis	150	Ingrowing Toe-nail	559
Empyema of Gall-bladder, Acute.....	231	Intercostal Neuralgia	645
Empyema of Mastoid.....	467	Intermittent Fever	295
Encephalopathy, Lead	141	Interstitial Keratitis	96
Endemic Neuritis	620	Intestinal Obstruction	703
Enteritis, Acute	709	Intestinal Paresis, Obstruction Due to...	707
Epulis	59	Intestinal Strangulation	706
Excretory Apparatus, Diseases of.....	113	Intussusception	706
Extrahepatic Jaundice	44	Ipecac	1
		Ipecacuanha Poisoning	2
Facial Paralysis	623	Iridectomy	12
Fæcal Obstruction	707	Iridochoroiditis	13
Fatty Degeneration in Acute Yellow		Iridocyclitis	7
Atrophy	203	Iris, Ciliary Body, and Choroid, Disorders	
Fatty Liver	226	of	5
Febris Biliaris	304	Iritis	7
Feeding of Infants.....	674	Iron	23
Fifth Nerve	643		
Fissures of Lips.....	510	Jaborandi	35
Fistula, Lacrymal	113	Jaborandi Poisoning	37
Fœtid Catarrh	577	Jalap	40
Fœtid Stomatitis	503	Jalap Poisoning	41
Follicular Stomatitis	502	Jambul	41
Foot-and-Mouth Disease	508	Jaundice	43
Foot-drop	616	Jaundice, Malignant	201
		Jaws, Diseases of.....	58
Galactocoele	347	Jequirity	63
Galactorrhœa	339	Jequirity Poisoning	64
Gall-bladder, Diseases of.....	227	Joints, Loose Bodies in.....	87
Gangrenous Stomatitis	506	Joints, Serous Effusion into.....	75
Gout, Arthritis of.....	78	Joints, Surgical Diseases of.....	65
Gum-boil	58	Juniper	93
		Juniper Poisoning	94
Hæmatogenous Jaundice	52		
Hæmatoma of the Dura Mater.....	377	Keratitis	95
Hæmaturia, Malarial	304	Kino	111
Hæmoglobinuria, Malarial	304	Knotting of Intestines.....	707

	PAGE		PAGE
Krameria	111	Mediastinal Abscess	367
Lacrymal Apparatus	112	Mediastinal Hæmorrhage	370
Lacrymal Duct, Stricture of.....	116	Mediastinal Vascular Disorders and In-	
Lacrymal Sac, Anomalies of.....	114	juries	370
Lactucarium	121	Mediastino-Cardiac Disorders and In-	
Lactucarium Poisoning	121	juries	368
Laryngitis and Kindred Disorders.....	121	Mediastino-pericarditis	370
Larynx, Œdema of.....	126	Mediastinum, Disorders of.....	367
Lead	139	Membranous Stomatitis	508
Lead Colic	141	Meningitis	375
Lead Encephalopathy	141	Meningitis, Cerebral	375
Lead Poisoning	140	Meningitis, Spinal	405
Leg, Neuralgia of Nerves of.....	645	Menopause, Disorders of.....	413
Lens, Diseases of.....	143	Menstrual Subinvolution	456
Lenticonus	152	Mentha Piperita	422
Leprosy	153	Mentha Virides	422
Leptomeningitis	380	Menthol	423
Leptomeningitis, Spinal	408	Mercurialism	432
Leukæmia	175	Mercury	426
Licorice	189	Mercury Poisoning	432
Linum	190	Methyl-blue	447
Lips, Diseases of.....	510	Methylene-blue	449
Lithium	191	Metritis	453
Liver, Abscess of.....	204	Microcidin	565
Liver and Gall-bladder, Diseases of.....	193	Middle Ear, Diseases of.....	458
Lobelia	232	Migraine	645
Lobelia Poisoning	233	Miliaria (Prickly Heat).....	483
Locomotor Ataxia	234	Miliaris Alba	485
Loose Bodies in Joints.....	87	Miliary, or Sweating, Fever.....	484
Lumbar Neuralgia	645	Milk, Breast-	674
Lumbar Puncture	401	Milk, Cows'	683
Lupulus	268	Milk, Modification of	684, 688
		Milk, Sterilization and Pasteurization	
Mace	269	of	686
Magnesia	269	Milk-laboratories	689
Malarial Fevers	274	Milk-sickness	486
Malarial Hæmaturia	304	Morphinomania and Opium Habit.....	487
Malarial Keratitis	97	Mountain-sickness	500
Malarial Neuritis	620	Mouth and Lips, Diseases of.....	501
Malarial Parasite	274	Mucous Polypi	583
Male Fern	336	Muguet	505
Male-Fern Poisoning	337	Muscles, Diseases of.....	513
Malignant Jaundice	201	Muscles, Surgical Diseases of.....	523
Malignant Onychia	559	Muscular Atrophy	515
Malt	338	Muscular Atrophy of Traumatic Origin..	525
Mammary Gland, Diseases of.....	339	Muscular Contractures	526
Manganese	348	Muscular Dislocation	524
Manganese Poisoning	348	Muscular Dystrophies	513
Mastitis	344	Muscular Hypertrophy	519
Mastoid, Empyema of.....	467	Musk	530
Mastoiditis	470	Mustard	530
Mastoiditis, Chronic	481	Myalgia, Traumatic	525
Measles	350	Myasthenia Pseudoparalytica	521
		Myocarditis	531

	PAGE		PAGE
Myopia	541	Ossification of Choroid.....	18
Myositis, Infectious	517	Ossification of Muscles.....	524
Myositis Ossificans	519	Ossifying Myositis, Progressive.....	519
Myositis, Progressive Ossifying.....	519	Otitis Media	459
Myotonia Congenita	521	Otorrhœa, Chronic	474
Myxœdema	547	Ozæna	577
Nævi of Lips	512	Pachymeningitis, Cerebral	375
Nails, Diseases and Injuries of.....	558	Pachymeningitis, Spinal	406
Naphthalin, Naphthol, and Allied Com- pounds	561	Palsies, Cerebral	141
Naphthol	564	Pancreatitis, Acute Hæmorrhagic.....	709
Nasal Cavities, Diseases of.....	566	Pannous Keratitis	98
Nasal Cavities, Tumors of.....	583	Pannus	98
Nasal Duct, Anomalies of	114	Panophthalmitis	16
Naso-pharyngitis	606	Paralysis, Bell's	623
Naso-pharynx, Diseases of.....	592	Paralysis, Crutch	612
Necrosis of Jaw.....	60	Paralysis, Facial	623
Neoplasms of Nerves.....	621	Paralysis, Pseudohypertrophic Muscular.	515
Nerves, Compression of.....	636	Parasite, Malarial	274
Nerves, Contusion of.....	634	Parasites in Lens.....	153
Nerves, Peripheral, Diseases of.....	611	Parasitic Stomatitis	505
Nerves, Surgery of.....	633	Parenchymatous Abscess	344
Nerves, Suture of.....	633	Paronychia	558
Nerves, Wounds and Injuries of.....	628	Parrot's Disease	509
Nerve-stretching	175, 627	Pasteurization of Milk.....	686
Neural Muscular Atrophy, Progressive..	515	Pediculi Corporis	439
Neuralgia	636	Perihepatitis	198
Neurasthenia	649	Perinephric Abscess	206
Neuritis	612	Peripheral Neuritis	615
Neuropathic Keratitis	96	Pernicious Malarial Fever.....	301
Nipples, Disorders of.....	340	Phlyctenular Keratitis	97
Nitric Acid	660	Phosphorus Necrosis	61
Nitric-Acid Poisoning	660	Pilocarpine	35
Nitrites	662	Poisoning, Abrin	64
Nitrites, Poisoning	664	Poisoning, Ipecacuanha	2
Nitrobenzene	667	Poisoning, Jaborandi	37
Nitrobenzene Poisoning	667	Poisoning, Jalap	41
Nitroglycerin	668	Poisoning, Jequirity	64
Nitroglycerin Poisoning	668	Poisoning, Juniper	94
Nitrous Oxide	671	Poisoning, Lactucarium	121
Noma	506	Poisoning, Lead	140
Nucleins	673	Poisoning, Lobelia	233
Nursing and Artificial Feeding.....	674	Poisoning, Male Fern	337
Nux Vomica	699	Poisoning, Manganese	348
Nux-Vomica Poisoning	700	Poisoning, Mercury	432
 		Poisoning, Nitric Acid	660
Obstruction, Fæcal	707	Poisoning, Nitrites	664
Obstruction, Intestinal	703	Poisoning, Nitrobenzene	667
Occupation Neuroses	620	Poisoning, Nitroglycerin	668
Œdema of Larynx.....	126	Poisoning, Nux Vomica.....	700
Onychia	558	Poisoning, Pilocarpine	37
Opium Habit	487	Polycoria	7
Ossiculectomy	479	Polymyositis	518
		Polyneuritis	615

	PAGE		PAGE
Polypi, Aural	478	Sweating Fever	484
Polypi, Mucous	583	Symptomatic Laryngitis	131
Polypi, Nasal	583	Synovitis	65
Post-febrile Neuritis	619	Syphilitic Arthritis	82
Post-nasal Adenoid Growths.....	592	Syphilitic Neuritis	619
Post-nasal Catarrh, Chronic.....	608		
Potassium Permanganate	348	Tabes Dorsalis	234
Prickly Heat	483	Tertian Fever	294
Progressive Muscular Dystrophies.....	513	Thomsen's Disease	521
Puerperal Subinvolution of Uterus.....	453	Thoracic Duct, Injuries of.....	370
Puncta Lacrymalia, Anomalies of.....	113	Thrush	505
Punctate Keratitis	97	Toe-nail, Ingrowing	559
Purpura	34, 47, 702	Tongue-like Lobes of Liver.....	193
Purulent Otitis Media.....	462	Torticollis	528
Purulent Rhinitis	570	Toxæmie Jaundice	52
Putrid Sore Mouth.....	503	Traumatic Keratitis	98
Pyopneumoperihepatitis	198	Traumatic Leptomeningitis	386
		Traumatic Muscular Atrophy.....	525
Quartan Fever	295	Traumatic Myalgia	525
		Tubercular Arthritis	83
Remittent Fever	274	Tubercular Leprosy	154
Rheumatic Arthritis	75	Tubercular Leptomeningitis	382
Rhinitis	566	Tuberculosis of Iris.....	22
Riga's Disease	509	Tumors of Biliary Tract.....	230
Rupture of Muscles.....	523	Tumors of Lips.....	511
		Tumors of Liver.....	214
Saturnine Neuritis	619	Tumors of Mediastinum.....	371
Sciatic Nerve, Neuralgia of	645	Tumors of Nasal Cavities.....	583
Sciatica	625	Tumors of Naso-pharynx.....	609
Secretory Apparatus, Diseases of.....	112	Tumors of Uveal Tract.....	17
Septic Arthritis	80	Twisting of Intestines.....	707
Septum, Diseases of.....	586		
Soor	505	Ulceration of Nipples.....	341
Sore Mouth, Putrid.....	503	Ulcerative Stomatitis	503
Spasmodic Torticollis	529	Uric-Acid Diathesis	192
Spinal Leptomeningitis	408	Uterus, Subinvolution of.....	453
Spinal Meningitis	405	Uveal Tract, Tumors of.....	17
Spinal Nerves, Inflammation of.....	625		
Spinal Pachymeningitis	406	Volvulus	707
Spinal Sclerosis, Posterior.....	234		
Sprue	505	Wangenbrand	506
Sterilization of Milk.....	686	Weaning	682
Stomatitis	501	Weil's Disease	56
Strain of Muscles.....	523	Wet-nursing	681
Strangulation, Intestinal	706	Wounds of Heart and Pericardium.....	369
Striate Keratitis	98	Wounds of Muscles.....	524
Stricture of Intestines, Obstruction Due		Wounds of Nerves.....	628
to	707	Wrist-drop	141, 432, 616
Stricture of Lacrymal Duct.....	116	Wryneck	528
Stricture of Rectum.....	707		
Subinvolution of Uterus.....	453	Xerotic Keratitis	99
Submammary Abscess	344		
Subphrenic Abscess	198	Yellow Atrophy of Liver, Acute.....	201
Suppurative Keratitis	99	Zona of Mouth.....	509

SAJOUS'S ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE.

I

IPECAC.—Ipecac is the root of the *Cephaëlis ipecacuanha* of A. Richard: a small shrub indigenous to Brazil, and belonging to the *Rubiaceæ*. It is also cultivated in India. Ipecacuanha contains an alkaloid called emetine, a glucoside called ipecacuanhic acid which resembles quinic and caffe-tannic acids, gum, resin, starch, a volatile oil, lignin, and sugar. The powdered root has a slight, but characteristic, nauseous taste. The alkaloid, emetine, usually described as white in color, is more usually, as noted by Merck, a light brownish, crystalline powder, of a bitter taste, and darkening upon exposure. It is soluble in alcohol and chloroform, slightly soluble in ether, and very slightly soluble in water. It is present in the root in a proportion of somewhat less than 1 per cent. The presence of two main alkaloids has been indicated in ipecacuanha: Cephæline and emetine.

Cephæline ($C_{14}H_{20}NO_2$) is a crystalline, monacid base, forming crystalline salts. Emetine ($C_{15}H_{22}NO_2$) is a non-crystalline, monacid base; it, however, forms very well defined crystalline salts. Both alkaloids in the free state are colorless, but are decomposed by light and turn yellow; their salts, on the other hand, are perfectly stable and afford a means of administering these substances unaltered.

The so-called ipecacuanhic acid is, in all probability, a mixture of a glucoside

resembling saponin and a substance giving a dark-green color-reaction with $FeCl_3$. Paul and Cownley (Pharm. Jour. and Trans., London, vol. liii, p. 61; vol. liv, pp. 111, 373, 690; and Amer. Jour. of Pharm., vol. lxxiii, 1901).

There are two genuine varieties, possessing three alkaloids: emetine, cephæline, and psychotrine. The last is present in only small quantities, is slightly poisonous, and of not much therapeutic importance. The other two are strongly irritating to the skin and mucous membranes, yet when injected do not cause necrosis or abscesses, being absorbed too rapidly, but show deleterious effects upon heart, gastro-intestinal tract, and kidneys. They should, therefore, be administered by mouth. Emetine is then the better expectorant, and cephæline the preferable emetic. R. Kobert (Ther. Monats., Aug., 1902).

Preparations and Doses.—The powdered root of ipecacuanha, $\frac{1}{2}$ to 30 grains.

The fluid extract (Extractum ipecacuanhæ fluidum), 1 minim to 1 fluidrachm.

The syrup (syrupus ipecacuanhæ), 5 minims to 6 fluidrachms.

The wine (vinum ipecacuanhæ), 5 minims to 1 fluidrachm.

The tincture of ipecac and opium (tinctura ipecacuanhæ et opii), 5 to 15 minims.

The troches of ipecacuanha (trochisci ipecacuanhæ), 1 to 2 troches.

The troches of morphine and ipecacuanhæ (trochisci morphinæ et ipecacuanhæ), 1 to 2 troches.

The powder of ipecac and opium (pulvis ipecacuanhæ et opii—Dover's powder), 5 to 15 grains.

Emetina, non-official, $\frac{1}{120}$ to $\frac{1}{8}$ grain.

Emetinæ hydrochloras, non-official, $\frac{1}{120}$ to $\frac{1}{8}$ grain.

Physiological Action.—Ipecac when applied locally to the mucous membranes and to the skin acts as an irritant. It gives rise to a papular eruption, which becomes pustular and proceeds to active ulceration if the application is persisted in. Internally, small doses frequently repeated give rise to nausea and increased flow of saliva and bronchial secretions. In persons sensitive to its influence vertigo and flushing may appear in addition.

In large doses these effects are increased in intensity, and vomiting occurs without producing excessive prostration, an excess of the drug being ejected before it has had time to induce very depressing effects.

These effects are mainly due to cephæline and emetine, as the two principal alkaloids of ipecacuanha possess—as shown by R. B. Wild—a powerful emetic action; the emetic dose of the latter (the hydrochloride) is, however, about double that of the former. In non-emetic doses the degree of nausea produced by cephæline is also about double that produced by emetine,—*e.g.*, the intensity and duration of nausea following cephæline are much the same as that following double the amount of emetine. Both alkaloids lower arterial tension, and little difference is apparent in small doses, but the depression produced by cephæline is less than that produced by the larger emetic dose of emetine. They cause contraction of the blood-vessels after destruction of the brain and spinal cord; but emetine

is distinctly more active than cephæline: 1 in 10,000 of the latter produces little, if any, effect, while 1 in 20,000 of emetine is followed by marked contraction. Cephæline is practically free from depressing effects when given in doses of $\frac{1}{16}$ to $\frac{1}{8}$ grain, but its action as an emetic is slow.

The irritating action of the drug upon the stomach is thought to represent the most active factor, though d'Ornellas has shown that hypodermic injections of emetine also produce emesis in animals. The action upon the central nervous system has not been established, but the contradictory evidence available would tend to show that it is but slightly influenced. It tends to depress cardiac action and has caused death in animals by paralyzing the heart. The pulmonary system seems to be depleted of its blood, judging from the pallor of the tissues post-mortem, an active hyperæmia of the gastro-intestinal tract apparently acting as compensating factor.

Both alkaloids are cardiac poisons. The injected animals die of cardiac paralysis. Emetine injures the heart in much smaller doses than cephæline and affects more the frequency of contraction, while the latter exercises its influence more upon the pressure. The characteristic intestinal symptoms are caused by both, but cephæline acts more upon the kidneys. Part of both alkaloids seem to be excreted through these organs. Poisoning with emetine leaves the lungs free of pathological changes; with cephæline there may be slight extravasations of blood. Vomiting may be induced by both, whether given by mouth or subcutaneously, but cephæline is undoubtedly superior in this respect, while emetine is the better expectorant. C. Lowin (Arch. Internat. de Pharmacodyn., vol. xi, fasc. 1 and 2, 1903).

Poisoning by Ipecacuanha.—In the lower animals lethal doses of emetine cause death by paralysis of the muscles

of respiration, the heart continuing to functionate after respiratory movements have ceased. The surface-temperature falls, but the internal temperature either remains stationary or suffers a slight rise, owing to the irritant action of the emetine upon the intestinal mucous membrane (d'Ornellas).

Post-mortem examination of animals killed by emetine reveals considerable gastro-intestinal irritation.

The lungs are generally hyperæmic and present patches of hepatization; less frequently they are exsanguinated. The internal use of ipecacuanha is sometimes followed by urticaria.

Treatment of Poisoning by Ipecacuanha.—Poisoning by ipecac or its alkaloid, emetine, is rare. The indications, however, are to remove the drug from the stomach, if possible, by means of the stomach-pump. External heat, whisky, ammonia, strychnine, and other respiratory stimulants should be resorted to.

Therapeutics.—Ipecac is a safe and efficient emetic. It is free from depressing and irritating effects when given in ordinary doses. On the other hand, it is sometimes slow in its action. Ipecac in emetic doses (4 to 20 grains of powder or 1 to 3 drachms of the syrup) may be used to empty the stomach in cases of acute indigestion, migraine, or bilious sick headache. In membranous croup, asthma, capillary bronchitis, lodgment of foreign bodies, pertussis, and in laryngismus stridulus it may be employed in emetic doses for its mechanical effects. In the bronchitis of small children, who swallow the mucus coughed up from the lungs instead of spitting it out of the mouth, emetic doses of ipecac will relieve the stomach and improve the condition of the lungs.

As an emetic in cases of poisoning it is inferior to mustard or the sulphate of

zinc or copper on account of its less efficient and slower action.

As an antemetic, in small doses ($\frac{1}{10}$ to $\frac{1}{4}$ grain of powder or $\frac{1}{2}$ to 1 minim of wine) repeated every half-hour or hourly, ipecac holds a high place. Given in this way we find ipecac useful in obstinate vomiting of drunkards, in the vomiting of pregnancy, the vomiting of migraine, and especially in nervous vomiting and the morning vomiting which sometimes accompanies general weakness of convalescents from acute diseases. In the vomiting of children with acute catarrh of the stomach, ipecac is useful. Ringer notes that ipecac has a greater influence over the vomiting of children than over that of adults. The vomiting occurring with cancer of the stomach is sometimes relieved by ipecac after the more commonly used remedies have failed (Ringer). Small doses ($\frac{1}{10}$ to $\frac{1}{6}$ grain of ipecac) are found beneficial where insufficient excretion of bile and torpor of the liver are present. In flatulent dyspepsia small doses ($\frac{1}{10}$ to $\frac{1}{4}$ grain) given after meals are followed by a subsidence of the flatulence. One grain of pulverized ipecac taken fasting every morning will remove the dyspepsia associated with constipation, depressed spirits, flatulence, cold extremities, and a feeling of weight in the stomach.

Case of a woman who had been subject to epileptic fits from the age of eight years. She had been more or less under treatment. Finally the bromide was reduced to a third of the former dose and vinum ipecacuanhæ added. A commencing dose of 10 minims was increased from time to time as the fits recurred, until 40 minims three times a day were given. The severity and frequency of the fits diminished under this treatment until May 3, '98, since when no fits have occurred. C. K. Bond (Lancet, Sept. 17, '98).

DISORDERS OF THE RESPIRATORY TRACT.—In the early stage of bronchitis,

when the secretion from the lungs is abundant and tenacious, ipecac will do good service in non-emetic doses. Murrell and Ringer recommend the inhalation of wine of ipecac, in the form of a spray produced by a hand-atomizer, in the treatment of winter-cough and bronchial asthma. The wine may be used pure or diluted with 1 or 2 parts of water. At the first application it sometimes excites a paroxysm of coughing, which generally soon subsides; but, should it continue, a weaker solution should be used. As a rule, the patient at first will bear about 20 compressions of the bulb without nausea. The inhalation should be used at first daily, and in bad cases two or three times daily, afterward every other day suffices, and the interval may be gradually extended. As the spray is used for its topical effect, the patient is directed to spit out, or even to rinse out, the mouth at each pause in the administration, for a much larger quantity of the wine collects in the mouth than passes into the lungs. In this way nausea and even vomiting are avoided.

Spray of ipecacuanha has given successful results in chronic bronchitis and bronchial catarrh. A single inhalation will sometimes restore the voice in hoarseness due to congestion of the vocal cords, and most cases of winter-cough will be relieved in ten days. The spray should be used warm for about ten minutes three to four times a day, and the patient should not go out for some minutes after inhaling. Either a hand-ball, spray-apparatus, or a steam-vaporizer may be employed. W. Murrell (Med. Press and Circular, Apr. 25, '88).

HÆMORRHAGE.—Ipecac possesses undisputed antihæmorrhagic properties. It may be used alone or combined with ergot or some other antihæmorrhagic agent. For this purpose ipecac should be given in frequently-repeated doses until vomiting ensues. It has been success-

fully used in hæmoptysis, epistaxis, menorrhagia, post-partum hæmorrhage, etc.

The wine of ipecac given in doses of 10 to 15 grains has been successfully used in uterine inertia in the first and second stages of labor.

INTESTINAL DISORDERS.—In acute dysentery ipecac is especially efficient. When the passages are large and bloody and the type is malignant, 60 to 90 grains are given first to produce vomiting. After vomiting has been induced small doses of 2 to 3 grains are given every hour, and continued until a profuse black stool occurs. This latter is a favorable prognostic sign; its non-appearance is significant of danger. The great depression is counteracted by the free exhibition of stimulants, and the vomiting by the use of opium and sinapisms to the epigastrium.

Cephæline and emetine have the same action upon man, but the emetic action of the former is considerably stronger. Locally applied to the upper or lower portion of the alimentary tract, both alkaloids are very irritating. An improvement in appetite was never seen; on the other hand, anorexia, aggravation of already existing stomach troubles and headache were quite frequent. Nausea regularly precedes emesis and there are no advantages over the powdered root. An action upon the upper respiratory tract is undoubted. P. Zepf (Arch. internat. de Pharmacodyn., vol. xii, fasc. 5 and 6, 1904).

In choleraic diarrhœa and cholera morbus ipecac, in dose of 3 grains, given every two hours, is followed by good results.

SKIN DISORDERS.—Ipecac is excreted in part by the skin (Binz), and we find that its diaphoretic properties may be utilized in the beginning of fevers, colds, and other inflammatory conditions, for which purpose it is associated with opium as in the official "pulvis ipecacuanha et

opii." In the dermatitis caused by rhus toxicodendron the free application of a wash consisting of 3 drachms of powdered ipecac to a pint of water is recommended by W. S. Gilmore. Neall recommends the use of 1 pint of powdered ipecac to 8 parts each of alcohol and ether to relieve the inflammation caused by mosquito-bites. Powdered ipecac made into a paste and smeared on the skin is said to relieve the pain and swelling produced by the sting of bees.

Ipecacuanha tried several years in Nicaragua, Central America; notwithstanding its vaunted efficacy, in dysentery no case derived much benefit from it. Patients suffering from dysentery could not always retain the large doses recommended in text-books. But $\frac{1}{2}$ -ounce doses of a saturated solution of magnesium sulphate and 15 minims of dilute sulphuric acid every two hours, with milk diet, caused all traces of blood to disappear from the stools in twenty-four hours, and there was a complete absence of the distressing nausea which is always present in the treatment by ipecacuanha. T. R. Wigglesworth (*Brit. Med. Jour.*, Feb. 26, '98). (See DYSENTERY, volume ii.)

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IRIDECTOMY. See CATARACT and IRIS.

IRIS, CILIARY BODY, AND CHOROID, DISORDERS OF.—The iris, ciliary body, and choroid, constituting the "uveal tract,"—the vascular or nutritive coat of the eye,—are best considered together.

The inflammations and degenerations that commonly affect the uveal tract are especially dependent on constitutional conditions.

Anomalies of the Iris and Choroid.—**ALBINISM.**—Absence of pigment in the uveal tract accompanies the lack of pigment in the hair and skin throughout

the body. The iris has a dull, gray-blue color, the pupil by ordinary illumination may appear red. With the ophthalmoscope, red fundus-reflex may be seen through the iris, and the choroidal vessels are distinctly visible against the yellowish-white background of the sclera. Such eyes usually present high errors of refraction, for which correcting lenses should be worn.

Instance of partial albinism of the iris in a man, 57 years old, who showed evidences of an anterior chorioretinitis complicating a peripapillary choroiditis. By focal illumination the iris presented a uniform coloration; its anterior layers were normal, and there were no signs of pathological change. When light was thrown into the eye, however, by the mirror of the ophthalmoscope, the inferior half of the iris permitted the rays to pass through its meshes. Thought to be due to congenital lack of development. Dujardin (*Jour. des Sciences Méd. de Lille*, Jan. 6, '93).

Light irides held to be a variety of albinism, an arrest of development of the pigment-granules, arising from an imperfect nutrition of the anterior section of the eye. Malgot (*Rec. d'Ophtal.*, Aug., '95).

ANIRIDIA is complete absence of the iris.

Instance of traumatic aniridia where the iris had slipped under the conjunctiva through a rupture in the sclera. By reason of the malposition of the iris it was possible to see the ciliary processes elongate under the use of eserine. The visual field was not larger than normal. Wintersteiner (*Inter. klin. Rundschau*, Aug. 23, '93).

Case of traumatic aniridia; no inconvenience save from excessive light. René (*Gaz. des Hôp.*, Oct. 9, '94).

Case of traumatic aniridia with conservation of lens. Ahlstroem (*Beiträge z. Augenh.*, vol. xvi, '94).

Partial aniridia and corectopia (slit-shaped pupil) represent a non-development of the arteries which, springing out into the anterior chamber from the major circle of the iris, collect about them the

tissue that makes up the iris-stroma. W. C. Posey (Arch. of Ophth., July, '97).

Cause of congenital irideremia is lack (usually hereditary) of sufficient formative material for the development of the eye. Matthias Lanckton Foster (Archives of Ophth., Nov., '98).

In aniridia opaque lenses should be removed as soon as possible. When the lens is displaced, according to the indications of the case, either a discission or extraction is indicated. A low degree of increased tension following the discission or extraction may yield to myotics. If the tension should not yield to eserine or pilocarpine, then anterior sclerotomy must be done. Joseph Andrews (Ophthalmic Record, Nov., '98).

When the patient passes out of a

when both "pupils" at once and equally contract. Should he desire a larger pupil, he pushes the bar to the right. This little apparatus has given great satisfaction to the patient for whose comfort it was devised. Königshofer (Clin. Ophth., Oct. 10, 1901).

COLOBOMA OF THE IRIS is an extension of the pupil usually downward. Displacement of the pupil is called "corectopia."

Microscopical examination of a case of typical inferior coloboma of the iris showing a cleft in the pigment-epithelium of the ciliary process, the pars ciliaris retinæ being continuous with the coloboma of the iris. The walls of the coloboma, which were turned outward, con-



Right eye. Cataract mature.

Left eye. Cataract immature.

Congenital irideremia with both lenses displaced upward. Actual size of cornea and lens: Vertical diameter, 9 millimetres; horizontal diameter, 10 millimetres; distance between pupillary centres, as in above drawing, *i.e.*, 61 millimetres. (Andrews.)

comparatively dark place into a brightly lighted one, he is apt to feel discomfort from the sudden "blinding" effect of much light. To relieve this, the writer suggests spectacles which, in addition to any necessary lens, are furnished with an apparatus exactly resembling the "iris diaphragm," with which many photographic lenses are supplied. This is, of course, duplicated, and the controlling rods are connected by a horizontal bar of very light construction, which passes across the lower part of the forehead. Matters are so arranged that when the "pupils" are medium in size the controlling rods point vertically upward; should the patient pass into bright light he has merely to push the horizontal bar gently to the left,

tained no trace of the sphincter pupillæ. The connective tissue, the mesoblastic portion of the ciliary process filling the space, showed no signs of previous inflammation. In the pupillary space proper there were numerous fibres and tracts of spindle-cells extending out upon the lens-capsule (persistent pupillary membrane). The posterior capsule was normal. The cause of the non-closure of the foetal cleft was not evident by microscopical examination. Holden (Archives of Ophthal., Oct., '92).

Corneal reflexes studied in several cases of bilateral corectopia by means of Javal's ophthalmometer. It was found that, in spite of a marked degree of eccentricity of the pupil, a part of that aperture always enters upon the corneal

zone, which is more or less central and is always included during the usual ophthalmometric examination Antonelli (*Annali di Ottal.*, vol. xxii, Nos. 2 to 5, '94).

COLOBOMA OF THE CHOROID is a congenital lack of choroid in some part of the fundus. Sometimes it is merely a rounded area through which the sclera is seen; sometimes it extends from the equator of the eye back to or including the optic disk. It is to be distinguished by its smooth, rounded margin from patches of choroidal atrophy, or retinal exudation.

PERSISTENT PUPILLARY MEMBRANE, the remains of the fibro-vascular membrane which closes the pupil during early foetal life, appears as one or more threads that stretch across the pupil, or from the iris to an opaque area of the lens-capsule within the pupil. They are distinguished from posterior synechiæ by the fact that they arise not from the margin of the pupil, but from the front of the iris at some little distance from the pupillary margin.

POLYCORIA, multiple pupils, may be caused by division of the normal pupil into two by a band of persistent pupillary membrane, or it may be from openings in other parts of the iris. Only the central or true pupil is furnished with a sphincter muscle.

Iritis; Cyclitis; Iridocyclitis.

Plastic inflammation of the iris and ciliary body includes iritis, cyclitis, iridocyclitis, parenchymatous and serous iritis, and the varieties of iritis named syphilitic, rheumatic, etc., according to the supposed cause.

SYMPTOMS.—Pain in and about the eye becoming severe, worse at night, and preventing sleep, is rarely absent. Redness is seen in the pericorneal zone; and the color of the iris is altered and the pupil contracted by hyperæmia. The

iris is thickened and its surface dull. Vision is impaired by haziness of the media, plastic exudate causes the iris to adhere to the anterior capsule of the lens, posterior synechia. When the ciliary body is much involved, dots of exudate are deposited on the posterior surface of the cornea, usually on a triangular area at the lower part, "keratitis punctata"; and the ciliary region is tender to touch.

The incipient symptoms of syphilitic iritis are generally very insidious, and consist in subjective sensations of light rather than failure of visual power. Almost every part of the eye is more or less affected. The retinitis may be monolateral. Hirschberg (*Deutsche med. Woch.*, Oct. 25, '88).

The cornea is affected in every case of iritis. In no case does it retain its perfect transparency. The opacities consist of deposits upon Descemet's membrane and infiltrations in the substantia propria. It is these deposits which cause the pupil and iris to appear blurred and hazy, and which are often referred to as muddiness of the aqueous humor. Friedenwald (*Arch. of Ophth.*, Apr., '96).

Two cases of painful iritis. In both the only sign of iritis was a slight sluggishness of the pupil. There was almost no injection, and what was present was not characteristic. In the first case synechiæ were found and the pupil was irregular. In the second the whole pupillary border was adherent to the lens. Walker (*Phila. Polyclinic*, Jan. 9, '97).

The synechiæ prevent the dilatation of the pupil under a mydriatic, which therefore becomes irregular in shape. In a few cases general adhesion of the iris to the lens occurs without much pain or redness of the eye.

ETIOLOGY.—Iritis may be caused by traumatism, but usually arises from some dyscrasia. Half of all cases are due to syphilis; other causes in the order of their frequency are rheumatism, anæmia, acute febrile diseases, diabetes, gonorrhœa, gout, and new growths in the iris. In syphilis it occurs in the secondary

stage within a year after infection. With rheumatism it may occur with or between other manifestations of the disease. It arises during convalescence from acute fevers.

Case of recurrent iritis occurring in a young woman who was subject to attacks of subacute rheumatism. The ocular symptoms yielded to salicylic acid. Foltz (*Chicago Med. Times*, Dec., '93).

Case of successful extraction of a piece of steel from an iris in which a plastic inflammation had been established, with prompt subsidence of the inflammatory reaction and restoration of full vision. Heckel (*Bull. de la Soc. de Méd. de Rouen*, Oct., '95).

Most forms of iridocyclitis result from the action of micro-organisms. Sydney Stephenson (*Lancet*, Feb. 29, '96).

Most inflammatory affections of the iris and ciliary body are the outcome of constitutional ailments, which are in turn due to microbic infection. In certain forms of iridocyclitis specific micro-organisms have been found in the anterior chamber. There exist good grounds for believing the proximate cause of all cases of endogenous iridocyclitis to be the excretion by the ciliary body of micro-organisms or their products. Therefore bacteriological examination of the aqueous humor might furnish a ready means of detecting an organism in those maladies thought to be of infectious nature, such as rheumatism. It might also lead to a correct conclusion as to the cause of doubtful cases of iridocyclitis. Stephenson (*Lancet*, Feb. 29, '96).

The flattening of the cornea against the iris by too firm pressure may set up iritis. Jocqs (*Le Bull. Méd.*, Mar. 8, '96).

Of 670 cases of iritis seen, but 1 was rheumatic in nature. (Calcutta Ophthalmic Hospital Reports; *Centralb. f. prakt. Augenh.*, Apr., '96.)

The cause of primary iritis investigated in 84 cases. The average age was 40.3 years. Tuberculosis was the cause in 31 cases (38.8 per cent.), chronic nephritis in 29 (34.5 per cent.), disease of the circulatory apparatus in 13 (15.4 per cent.), syphilis in 5 (5.9 per cent.), and various other affections in 6 (7.1 per cent.). General diseases play an impor-

tant part in the production of primary iritis. Michel (*Münchener med. Woch.*, June 19, 1900).

Syphilitic iritis occurs in the transition or secondary period of the disease—as a rule, between the fifth and twentieth months. It may rarely be found earlier or later. The writer reports six cases, in all of which syphilitic iritis appeared from six to thirty years after the primary lesion. All these patients had mercurial treatment in the beginning. As no other causes were found to explain the iritis, and injections of mercurial biniodide caused recovery, the condition, though late, was probably syphilitic. Terson (*Jour. des Praticiens*, Aug. 23, 1902).

The patient never lived in a malarial district except for one month. The incubation period from the time she was bitten to the time that she became ill was less than four weeks; there were no other signs of malarial infection to suggest an examination of the blood; dilatation of the pupil with atropine was accomplished with difficulty, and finally prompt relief followed the use of quinine. S. D. Jacobson (*Amer. Medicine*, Feb. 8, 1902).

In rheumatic fever a minute diplococcus is present in many situations. This organism is cultivable outside the body, and produces, when injected into rabbits, lesions identical with those of rheumatic fever, and in some few cases iridocyclitis. The organism is the true cause of rheumatic fever, and the lesions are experimental iridocyclitis. The rabbit appears to have less resisting power toward this diplococcus than man has; hence a serious iridocyclitis is likely to be very rare in the latter. Poynton and Paine (*Ophthalmoscope*, October, 1903).

DIAGNOSIS.—Iritis and cyclitis nearly always co-exist. Iritis may be considered absent if there is no visible alteration of the iris and the pupil dilates widely and evenly under a mydriatic. Cyclitis is absent if there be no deposit on the cornea, or haziness of the vitreous, or tenderness of the ciliary region. Iritis and cyclitis must be distinguished from keratitis by

absence of change in the cornea; from glaucoma of the contracted pupil, and the absence of dilated scleral veins, increased tension or cupping of the optic disk; from panophthalmitis by the absence of swelling of the lids and dense opacity of the vitreous; from neuralgia by the redness of the eye and the alteration of the iris; from conjunctivitis by the slight swelling and freedom from discharge of the conjunctiva. The alterations in the pupil are best seen with the ophthalmoscope or after the use of a mydriatic.

Study of the manifestations of syphilis in the ciliary body. Conclusions: 1. Whenever syphilitic iritis is accompanied by a punctate keratitis, either chronic or recent, areas of atrophic choroiditis will be found in the ora serrata. 2. In parenchymatous interstitial keratitis, when due to hereditary syphilis, disseminated plaques, which sometimes reach to the posterior segment, are seen in the ora serrata; more often, however, they are confined to the ciliary region. 3. Diffuse syphilitic choroiditis with disease of the vitreous always presents atrophic alterations of the ora serrata, and the opacities of that humor are due to this latter lesion. 4. In ataxic atrophy of the disks atrophic and pigment changes occur in the ora serrata. 5. In syphilitic inflammation of the cerebral or cerebro-spinal nerves characteristic signs of the disease appear in the ora serrata. Galezowski (*Gazette des Hôp.*, Apr. 18, '94).

1. It is important, from a clinical point of view, to differentiate a tubercular variety of iritis. 2. This form of inflammation is premonitory of the tubercular nodular eruption, which it may precede by several weeks. 3. It is characterized by its subacute mode of invasion; its evolution is slow and torpid, being marked by faint reactional signs, although in addition there may be dense synechiæ more or less completely obstructing the pupil. 4. The absence of pathognomonic symptoms renders the diagnosis difficult. 5. The tendency to spontaneous cure of miliary tuberculosis of the iris depends upon the individual

resistance, and especially upon the resistance of the iris. The incapsulation of tubercle of the iris and the rapid obliteration of the surrounding capillaries favor its isolation and the protection of the sound tissue. It is not the attenuation of the bacillus nor of the toxins which brings about resolution, but the character of the tissue which receives the poison. Vignes (*Recueil d'Ophtal.*, Apr., '94).

Microscopical study of an eye with supposed tubercular iritis, in a girl, 15 years of age, without definite tubercular history. The affection began as a brown spot at the base of the iris and was followed by the appearance of other similar areas, and, later, by blindness. The growth consisted of a granulomatous-looking mass (with a few ill-defined giant-cells) situated near the base of the iris and blocking the angle of the anterior chamber. Benson (*Dublin Jour. Med. Science*, Jan., '95).

Painless iritis, easily mistaken for less serious diseases, and readily diagnosed by the instillation of a mydriatic, is an insidious and dangerous affection, because not brought to the notice of the oculist until late in the disease, when synechiæ have formed. G. Walker (*Phila. Polyclinic*, Jan. 9, '97).

Importance of clearly separating from iritis of the ordinary type certain cases hitherto classified with it, but in which only the posterior layer of the iris, the uvea, is involved. These cases grouped under the term "uveitis." The two affections differ in all respects as to symptoms, course, causes, and cure.

Uveitis is observed exclusively among women; iritis is more frequent among men. Uveitis always affects both eyes; iritis often affects but one. Uveitis lasts for years, and is manifested by slight periodical exacerbations, lasting five or six days; iritis is far more violent in its manifestations, but is cured in a month or two. The usual causes of iritis are syphilis, rheumatism, and gout. These are not the causes of uveitis, whose causes are unknown. Atropine is of great value in the local treatment of iritis; but iridectomy is the only effective local treatment for uveitis.

The differential diagnosis during the attack may be made by noting that in

iritis there is always marked discoloration of the anterior surface of the iris, which in uveitis is not perceptible. In iritis the pain and hyperæmia are violent; in uveitis pain is almost or quite absent and hyperæmia slight. In iritis, even apart from adhesions, the pupil dilates imperfectly with atropine; in uveitis it dilates freely, except in so far as it is bound down by old synechiæ. Grandclément (Lyon Méd., tom. xxxii, No. 34).

The diagnosis of iritis must be made on the one hand from conjunctivitis, and on the other from glaucoma. The character of the infection, the pain, and the condition of the vision will separate these two. The movements and state of the pupil will give the diagnosis between glaucoma and iritis. This latter is most important, since atropine, which is all-important in iritis, is deadly in glaucoma. Lloyd Owen (Birmingham Med. Review, Nov., 1903).

PROGNOSIS AND SEQUELÆ.—Iritis is a slow, painful, disease dangerous to the future usefulness of the eye. Eyes that do well may take many weeks to recover; and pain may continue or increase many days after efficient treatment is begun. It is liable to relapse or recur, especially in rheumatic or cachectic patients. When the whole margin of the pupil is bound down to the lens, exclusion of the pupil, the forward current of fluid from the posterior chamber is obstructed, pushes forward the iris, and causes secondary glaucoma. Extensive plastic deposits about the lens and in the vitreous are followed by softening and shrinking of the eyeball with detachment of the retina, blindness, and degenerative changes in all parts of the eye. Few cases of iritis recover absolutely, although many eyes remain quiet and useful throughout life.

In New Orleans cases of iritis are of much shorter duration (average of eight cases 12.6 days) than at other places where the relative humidity of the atmosphere is greater. Ayres (New Orleans Med. and Surg. Jour., Aug., '88).

The only case in ophthalmic literature

of vascular formation of the lens-capsule during chronic iritis. The iris had been the subject of repeated attacks of inflammation leading to extensive synechiæ. The new veins and arterics were distinctly seen ramifying on the lower outer section of the capsule. Darier (Ann. d'Ocul., Jan., '95).

Corneal complications occurring in the course of or after plastic iritis: fine dust-like deposits upon the membrane of Descemet, large deposits similarly located (descemetitis), linear infiltration of the substantia propria, at times assuming the appearance of circumscribed sclerotizing keratitis, and in one case resembling keratitis punctata vera. Friedenwald (Arch. Otol., Apr., '96).

Serous iritis never exists without coincident cyclitis and choroiditis, and sometimes hyalitis. W. Cheatham (Ophth. Rec., Aug., '97).

Sometimes iritis causes a myopia that may last for some months.

TREATMENT.—The eye should be promptly put under the influence of a mydriatic, preferably atropine, which should be continued until the eye is free from redness, except in a few cases of cyclitis without iritis, which do better with the pupil undilated. The prevention and breaking up of synechiæ by such a drug is usually of greatest importance. The eyes should be given complete rest, and protected from sudden changes of light. Dark glasses may be worn in the sunlight. The general nutrition of the patient is so important that confinement to a dark room should not be continued more than a few days. Pain may be relieved by bathing the eye with very hot water from three to five minutes several times a day; or by taking blood from the temple.

Scopolamine hydrobromate acts very energetically, often removing synechiæ which atropine had failed to influence. Quickly removes pain of iritis and other inflammations of the anterior portion of the eyeball; scarcely any unpleasant by-effects. One to 2 per 1000 strong

enough for ordinary purposes. Repeat instillations three or four times a day. Raehlmann (*Wiener med. Woch.*, No. 20, '94).

Hydrobromate of scopolamine is of the greatest value in the local treatment of the various forms of plastic iritis.

For quick and active measures, which are so eminently necessary in incipient cases of plastic iritis, and during the early stages of inflammatory reaction, the scopolamine salt is to be preferred to the atropine; but where prolonged use of such drugs is necessary, as in many cases of the chronic form of the disease with subacute exacerbations, the alternate employment of scopolamine and atropine seems empirically to be the best method of local administration that has been devised.

The best method of instillation is by dropping the solution upon the upper corneal border while the lower punctum is everted and the corresponding canaliculus is pressed upon; and the most efficient amount to be used at one sitting is 2 drops of a $\frac{1}{10}$ of 1-per-cent. strength (1 to 500), repeated, if necessary, as often as three times during the course of an hour, and preceded, when desired, as in some instances where there are much irritation and pain, by 2 drops of a 2-per-cent. solution of hydrobromate of cocaine a few minutes before each instillation of the scopolamine. Oliver (*Amer. Jour. Med. Sciences*, Nov., '96).

Dionin used in a number of cases of iritis; the pain was quickly relieved and no unpleasant constitutional or local effects resulted when a 2-per-cent. solution was used. J. W. Ingalls (*Brooklyn Med. Jour.*, p. 698, 1900).

In some cases of iritis surgical interference becomes necessary. If the tension remains permanently raised, a paracentesis may be performed; this will always lower the tension temporarily, and is so simple a procedure and so devoid of risk that it should be used much more frequently than at present. In the chronic congestion which attends obstinate cases a radiating puncture of the sclerotic has been found of great value. Lastly, if the tension persists, an iridectomy may be required in acute

stages; when the pupil is occluded or excluded it is urgently demanded. In relapsing iritis, surgeons with von Graefe, often perform iridectomy. This should be done with discrimination during an interval of quiescence. Lloyd Owen (*Birmingham Med. Review*, Nov., 1903).

Internally calomel should be given until the bowels are freely moved; and mercury continued by inunction or in other forms in the syphilitic cases. Whatever constitutional condition is present is to be carefully treated; and tonics used to build up the general condition.

Analysis of 105 personal cases. Acute plastic iritis, whether specific or not, is a self-limited disease; while local treatment is of the greatest value in soothing the pain and preventing adhesions, constitutional treatment will not tend to shorten the duration of the disease. Bruns (*Med. News*, July 20, '95).

Marmorek's serum in small and repeated doses ($\frac{1}{2}$ a cubic centimetre daily at first, rising to 1 cubic centimetre or more) seems to arrest the rheumatic process after one of the three to six successive advances which together constitute acute rheumatic iritis. In chronic and long-standing rheumatic iritis with organized adhesions, sclerosis, or atrophy of the iris, the normal course of cyclical evolution does not occur, and the influence of any therapeutic agent is, therefore, less easy of demonstration. In cases of relapsing acute or chronic iritis, the serum produces some amelioration of the visual function. Boucheron (*Gaz. Hebdom. de Méd. et de Chir.*, June 16, '98).

Case of violent iridocyclitis in a man who had general ciliary injection, contracted pupils, extensive posterior synechiæ, and deposits on the posterior surface of the cornea. T. + 1. V. R. $\frac{6}{60}$, L. $\frac{6}{24}$. After twenty-one hypodermic injections of $\frac{1}{8}$ grain of pilocarpine muriate, extending over seven weeks, and 60 grains of potassium iodide daily with mercury occasionally, improvement was rapid and pronounced. V. increased to R. $\frac{6}{24}$, L. $\frac{6}{15}$. There were no relapses,

tension became normal, and the exudation was promptly absorbed. Six months later V. had increased to R. $\frac{1}{6}$, L. $\frac{1}{6}$ with -50° , Ax. 90° . R. R. Tybout (Columbus Med. Jour., Dec. 20, '98).

In the treatment of iritis due to constitutional disease hot foot-baths, salts, and small doses of calomel are serviceable in nearly all cases. Local treatment consists in placing the patient in a darkened room, the administration of atropine, hot applications, and puncture of the cornea. If but one eye is affected, there should be placed in the other eye, once each day, a drop of a 1 to 5000 solution of atropine. For congestion and pain a 1 to 50,000 solution of corrosive sublimate, as hot as can be borne, applied to the eye on a large pad of cotton for a half-hour several times a day is highly recommended. N. B. Jenkins (N. Y. Med. Jour., Feb. 24, 1900).

A patient having taken four or five 60-grain doses of salicylate of soda every three hours by mistake, marked improvement of the uveitis occurred. In subsequent uses of large doses the writer noticed similar response in this disease. Maragliano states that it is not a depressant of the heart, for the arterial pressure is elevated in moderate dosage. In severe cases the writer gives 40 grains of the salicylate every two or three hours till relief is obtained. Morton (Ophthal. Record, Jan., 1903).

Iridectomy.—The excision of a part of the iris may be required for the sequels of iritis, as exclusion of the pupil or extensive synechia; for occlusion of the pupil, its closure by a deposit of lymph; for corneal opacity in front of the pupil, some part of the cornea remaining clear; for partial opacity of the lens; or for glaucoma.

Location.—If done to secure a clear passage for light through the dioptric media, "optical iridectomy," it must be located so light can enter through the best dioptric surfaces, must be as small as will remain subsequently unobstructed and must be exposed when the lids are

opened. If it is merely to free the iris from its adhesions, or open up a passage from the posterior to the anterior chamber, or for glaucoma, it should be placed where it will ordinarily be hidden as much as possible beneath the lids. For glaucoma it should be large, including one-fifth of the circumference of the iris, and should extend up to the ciliary margin.

Technique.—An incision is made in the cornea between the location for the iridectomy and the corneal margin, slightly longer than the width of the iridectomy and parallel to the corneal margin. This is made either with a narrow Graefe knife or a lance-shaped keratome. A pair of iris-forceps is introduced and the iris seized near its pupillary margin, and the part so caught is drawn outside the corneal incision. Sometimes the iris can be better separated from adhesions by a blunt iris-hook which is pressed upon the pupillary edge of the iris until it catches under it, and draws it out through the corneal incision. A sufficient portion of the iris having been drawn out, it is cut off with fine scissors, the stump is returned within the eye, care being taken to free it entirely from the corneal incision; and the eye is closed with a light dressing until the corneal wound ceases to allow the escape of the aqueous, usually but a few hours. Iridectomy should not be done for the sequelæ of iritis until long after the eye has become free from redness or irritability.

In iridectomy instead of drawing the iris out and stretching (perhaps tearing) the fibres, so that the resultant coloboma is irregular and misplaced, two incisions four to five millimetres wide, one above and the other below, should be made. The de Wecker scissor-forceps are then introduced into the lower section, and the pointed branch is slipped beneath the iris. Incisions are now made to the right and the left, thus circumscribing

the summit of a triangle. The forceps are now introduced from above, the flap is withdrawn and is cut squarely off by a third snip. In this way a large, gaping opening is formed, with the apex of the triangle directed downward. Abadie (*Annales d'Ocul.*, June, '88).

The following operation devised for the treatment of iridodialysis from contusion: "A narrow, somewhat slanting incision was made in the cornea, near the sclero-corneal junction, with a broad needle or a very small keratome. Fine forceps are introduced, and the iris, near its detached periphery, is seized and drawn into the wound. A small portion is drawn through the wound, enough only to insure being held in position by a compress bandage, till healing has taken place. In order to more thoroughly secure its maintenance in the wound, a fine suture may be passed through the conjunctiva at the border of the wound, and the iris stitched thereto. The suture may be removed in forty-eight hours." Operation successfully performed in four cases. E. Smith (*Jour. Amer. Med. Assoc.*, Sept. 19, '91).

Case of syphilitic iritis with gummatous formations in both irides, in which iridectomy was successfully performed after the iris-tissue had become atrophic. Myers (*Va. Med. Monthly*, June, '93).

In anterior synechiæ the synechiæ are cut through by means of a special blunt-pointed knife, the blade of which is curved to represent the third of a circumference and having a diameter of seven to eight millimetres. An opening less than one millimetre long is made in the cornea with a Graefe cataract-knife, parallel to the radiating fibres of the iris, care being taken to avoid wounding the iris and the lens. The synechotome is then introduced between the cornea and the synechiæ and the latter are cut through by traction with the curved knife. Atropine and bandage complete the operation. The following are necessary conditions for the operation: 1. The synechiæ ought to be sufficiently central, that the knife may pass between the point of attachment of the iris and its great circle. 2. At the point chosen for

the puncture of the cornea the anterior chamber must be deep enough to prevent a wounding of the iris or to produce an adhesion in this place. Gaupillat (*Recueil d'Ophtal.*, June, '95).

In order to avoid prolapse of the vitreous in iridotomy or iridectomy for occlusion of the pupil, a narrow knife should be introduced through the corneo-scleral junction and the iris incised before the counter-puncture is made in the limbus on the opposite side. Segal (*Novotschen-Kask, Vestnik of Ophth.*, Jan., Feb., '96).

Choroiditis.

PLASTIC INFLAMMATION AND ATROPHY OF THE CHOROID is more of a chronic degenerative process than an acute inflammation. It often accompanies similar inflammation of the iris and ciliary body, and is variously designated "choroiditis," "iridochoroiditis," and "choroidal atrophy."

SYMPTOMS.—Only the appearances revealed by the ophthalmoscope are characteristic of this disease, although it may be attended with discomfort or aching in and about the eyes, flashes of light, impairment of vision by scotomata, or clouds due to vitreous opacities. In the early stages of exudation the choroid may be swelled, is lighter color, yellower than normal; and may be veiled by haziness of the vitreous; but there are no pigment deposits. Later, as the process passes on to atrophy, the margins and parts included in the affected area show brown or black pigment deposits, between which may be seen the large vessels of the deep layer of the choroid or the white sclera. Throughout the disease the retinal vessels run over the affected area undisturbed. When the atrophy and pigment deposits are complete, the appearances produced tend to continue throughout life.

ETIOLOGY.—The causes of inflammation of the iris and ciliary body similarly affect the choroid. In addition, it is

liable to suffer from eye-strain in hyperopia, astigmatism, and most extensively in myopia. Excessive use of the eyes and exposure to excessive light and heat, especially when habitually concentrated on one part of the choroid, are also important causes.

Case of double chorioretinitis in the macular regions, following a flash of lightning and a flash from burning lycopodium. The patient, a man 21 years of age, was stunned by a stroke of lightning and upon recovering was unable to see for several moments, the sight returning first in the right eye. Later in the same day he was exposed to a flash of lycopodium powder. The following day he noticed scintillating scotomata, which persisted in greatly varying forms, together with micropsia in the right eye. In the same eye, directly in the macular region, the retinal tissue seemed to be slightly puffed into an irregular flattened mass. The tissue itself did not appear to be opaque or discolored, but glistened in places as though the underlying material was composed of an extremely-thin coating of cicatrizing, almost transparent jelly. In both eyes the nerve-head was a trifle gray and hazy. The left eye was similarly affected, though to a less degree. The visual fields were normal in extent, but exhibited a series of relative scotomata. Three months later a small hæmorrhage was visible between the choroid and retina below the left fovea. The patient made almost full recovery. Oliver (*Internat. Med. Mag.*, Oct., '96).

Conclusions based on a study of metastatic choroiditis:—

1. Metastatic choroiditis, or suppurative panophthalmitis, may follow septic infection through the genital tract after labor.

2. As a rule, both eyes are affected, although one alone may be affected.

3. The disease first commences in the uveal tract, afterward involves the vitreous humor, and finally is exhibited in great swelling of the lids, with chemosis of the conjunctiva, and, usually, rupture of the cornea or sclera, or both.

4. The prognosis for sight is bad in all cases.

5. The prognosis for life is worse when the disease is bilateral than when it is unilateral, and is bad in all cases.

6. Endocarditis is present in the majority of cases.

7. Surgical interference is distinctly contra-indicated. J. Herbert Claiborne (*Annals of Ophth.*, Apr., '97).

Five cases of choroiditis in young patients caused by excessive functional activity of the eyes. Diminished tonic activity of the tissues and circulation incident to in-door work, vitiated air, want of sunlight, lack of exercise, and indulgence in improper food. A. C. Corr (*Amer. Jour. of Ophthal.*, July, '98).

Five cases of iridochoroiditis in which the lesion was characteristically that of gonorrhœa. Inflammation of the uveal tract, due to this cause, develops much more rapidly than the ordinary rheumatic iritis and choroiditis and the plastic character of the inflammation is less pronounced, it being rather of a serous variety. It never seems to follow the urethritis immediately, but is invariably preceded by an arthritis usually of the knee-joint. The iritis or choroiditis is distinct from the ordinary type in being sudden in its onset, very rapid in its development, accompanied by severe pain and a rapid and complete loss of vision. Though the inflammatory process is obstinate and subject to frequent relapses, it eventually subsides and usually leaves no trace behind. There is almost never any gelatinous or fibrinous exudation into the anterior chamber and the main cause for rapid and marked deterioration of vision seems to be due to a general serous infiltration of the iris and choroid and a diffuse infiltration into the aqueous and vitreous humors. Synechiæ seldom occur, and, if they do, they are easily broken. When the patient incurs another attack of gonorrhœa, the iritis is again liable to manifest itself; but the disappearance of the iritis under appropriate treatment without leaving synechiæ proves the absence of the plastic character, and at once distinguishes it from the usual form of serous iritis. Leeches, atropine, and hot fomentations with sodium salicylate internally, and an ap-

propriate treatment for the urethritis are usually followed by satisfactory results. C. S. Bull (Medical Record, Dec. 20, 1902).

VARIETIES.—When one or two large areas of the choroid are affected at once it is called *diffuse choroiditis*. When small areas are affected the remainder of the choroid being normal, it is called *localized choroiditis* if only one or two patches appear, or *disseminated choroiditis* if there are several. When the region of the macula is involved it is called *central choroiditis*; and a form of the central occurring in old persons is called *senile*.

DIAGNOSIS.—Choroiditis is recognized with the ophthalmoscope by the color and pigmentation of the affected areas. It has to be distinguished from exudation or opaque nerve-fibres in the retina and from coloboma of the choroid.

Tuberculosis of the choroid is to be distinguished from glioma of the retina by the early appearance of inflammatory symptoms, including iritis: phenomena which are wanting in this stage in glioma. Wagenmann (Deutsche med. Woch., Oct. 1, '91).

PROGNOSIS.—Choroidal inflammation is always serious. Its obscure, persistent causes, difficult of recognition and removal, make it generally a disease liable to continue until it has done very grave damage to the eye. It is worth every effort to permanently check its progress. Cases where it is localized and does not involve the macula are the most favorable, and may end in cure without noticeable impairment of vision.

TREATMENT. — Complete rest for the eyes, often under a mydriatic, is important, with protection from sudden changes or great excess of light, or exposure to heat. This will sometimes require a change of occupation, as the giving up of cooking or blacksmithing.

Correcting lenses must be constantly worn, and during the acute stage much use of near vision should be avoided. The underlying dyscrasia must also receive efficient treatment, for upon this will depend the persistence and extension of the disease and the ultimate results. Syphilis should be combated by the prolonged use of mercury; with, sometimes, iodides late in the disease. A general tonic regimen is generally required. Outdoor life is beneficial, and on account of its depressing influence upon general nutrition prolonged confinement to a dark room should be carefully avoided.

Improvement obtained in a case of specific choroiditis by the application of mercurial inunction. The patient had a marked intolerance for potassium iodide and the bichloride of mercury. Micleso (Bull. de la Soc. des Méd. et Nat. de Jassy, '92).

Case of choroiditis of several months' duration in which, notwithstanding the use of iodide of potassium, etc., vision was reduced to light-perception. Gradual improvement occurred under the hypodermic use of pilocarpine in doses of from $\frac{1}{8}$ to $\frac{1}{2}$ grain. Fryer (Kansas City Med. Index, '92).

Case of metastatic exudative mucopurulent chorioretinitis, with complications following remittent fever, studied in which the fellow-eye showed symptoms of sympathetic irritation. Removal of the exciting eye was followed by complete recovery of the sympathizing one. Schwartzschild believes that the sympathetic affection was caused by the traction of the inflammatory exudate upon the ciliary processes, and that the disease is a neurosis of reflex origin. Weber and Schwartzschild (Amer. Jour. of Ophthal., Apr., '93).

Case of suppurative iridochoroiditis; recovery by subconjunctival injections of bichloride, mercurial inunctions, and injections of bichloride, with atropine and hot compresses. Coppez (Revue Gén. d'Ophthal., Sept. 30, '95).

Conclusions regarding the treatment of

choroiditis: 1. The subcutaneous injections of iodine are more efficacious than other iodized preparations in the affections of the uveal tract amenable to this treatment. 2. Such affections are disseminated choroiditis, fibrinous irido-choroiditis, and iridosclerochoroiditis. In the last two they should be joined with the usual remedies, particularly cauterization. 3. The injections are especially valuable in choroiditis of rheumatic and of bacillary origin. 4. In specific forms they are no better than iodides, and are inferior to mercury. 5. The daily doses vary from 0.1 to 0.4 centigramme; the reaction is insignificant. Vignes (Archives d'Ophtal., Aug., '96).

Lapersonne's (of Lille) new method of evisceration by actual cautery: Under anæsthesia the cornea is split vertically and horizontally into four sections. When the pus has escaped, the thermocautery, heated to a red heat, is passed into the eye, and stirred about until all the contents of the sclerotic coat are destroyed,—vitreous, retina, and choroid,—and the optic disk finally burned with the point of the instrument. The remaining shell is then thoroughly syringed out with an antiseptic solution, and filled up with powdered iodoform. No sutures or dressings are applied. Not only is a fair stump obtained, but the inflammatory reaction in the orbital tissues is rapidly checked. Panas (Edinburgh Med. Jour., Dec., 1900; from L'Echo Méd. du Nord, 1900).

Purulent Inflammation of the Iris, Ciliary Body, and Choroid.—Although in grave plastic iritis hypopyon may appear, the exudate becoming largely purulent, these cases running the general course of plastic iritis require no separate consideration. A totally distinct clinical picture is presented when general suppuration of the uveal tract occurs, called "suppurative choroiditis," or "iridochoroiditis," or, from its involvement of all parts of the eye, "panophthalmitis."

SYMPTOMS.—The disease begins with

great disturbance of vision, pain in and about the eye, and general redness. The conjunctiva, the lids, and often the tissues of the orbit become greatly swelled. Haziness of the vitreous quickly prevents any view of the fundus; and the eye rapidly becomes entirely blind. The pain continues to increase until the sclero-corneal coat is perforated, allowing exit to the contained pus. Then pain rapidly diminishes, the swelling goes down and the eyeball soon shrinks to a small, sightless, and generally harmless stump: *phthisis bulbi*.

ETIOLOGY.—Suppuration of the uveal tract arises from infected wounds, either accidental or operative; from perforating ulcer or abscess of the cornea; or thrombosis of the orbital veins in orbital cellulitis. It may also be produced by metastasis or embolism in connection with abscess in other parts of the body, or in pyæmic conditions, puerperal sepsis, or erysipelas, or in cerebro-spinal meningitis, influenza, scarlatina, and other acute specific fevers.

DIAGNOSIS.—The disease cannot escape notice unless masked by previous inflammation of the orbit, erysipelas of the lids, or suppuration of the cornea; or unless it occur in the course of exhausting disease, when the local reaction may be slight, and the loss of vision unnoticed by the dull or unconscious patient. It is to be distinguished from other ocular inflammations, by the opacity of the vitreous and rapid loss of sight; or when it supervenes upon corneal ulcer, by increase of pain and swelling.

PROGNOSIS.—Most cases run a rapid course to complete blindness and *phthisis bulbi*. In a few the reaction is less severe and a purulent accumulation in the vitreous simulating in appearance glioma of the retina remains indefinitely. Such cases are called "pseudoglioma." In a

very few cases in children, where the purulent choroiditis follows specific fevers, and especially cerebro-spinal meningitis, some sight is retained, and the vitreous humor may subsequently clear up to a considerable extent.

Case of panophthalmitis from infection with the micrococcus lanceolatus without a perforating wound of the eyeball. The infection in this case apparently proceeded from within, but its focus was undiscoverable. The case shows the possibility of infection from within in cases of slight contusion which probably reduce the vitality of the tissues, also the possibility of the entrance of micro-organisms into the circulation through lesions too small to be visible. J. E. Weeks (Ophth. Rec., Feb., 1903).

TREATMENT.—Pain is most promptly relieved and the disease cut short by enucleation of the eye; but this has in a few cases been followed by death from meningitis. Some authors believe that the risk of meningitis is increased by enucleation; but this is very doubtful if proper care is taken to cleanse the wound and secure free drainage.

When, because of the patient's condition or disinclination, enucleation cannot be done, the eye should be poulticed, and after two or three days opened by a free incision across the cornea that will permit the escape of the crystalline lens and all purulent accumulations. Analgesics, such as morphine and acetanilid, may be necessary until the eye is opened. If the eye retains some sight, poulticing is improper; rest, atropine, and bleeding from the temple are indicated. Even where the eye is blind, but the pain and swelling not severe, as in pseudoglioma, it may be wise to defer operation until the general health is improved.

Results of 278 iridectomies to prevent the recurrence of attacks where the pupil was more or less completely closed by synechiæ. They were favorable in

a large majority of cases; the inflammatory phenomena were lowered, and the ocular tonus brought nearer to normal, and vision, both central and peripheral, was improved. Failure was usually the result of too long delay. Immermann (La Clinique Ophthalmol., Aug. 25, 1903).

Tumors of the Uveal Tract.—This is a not very unusual seat of secondary tumors, although they may attract little attention, appearing late and growing slowly. The following are the principal primary new growths.

CYST OF THE IRIS is apt to follow a penetrating wound in which a bit of epithelium or eyelash has been implanted on the iris. It may have the form of a serous cyst occupying a large part of the anterior chamber, or an epithelial pearl on the surface of the iris. Either form may cause secondary glaucoma. It should be excised.

Cyst of the iris observed to develop after the performance of an iridectomy, with removal of a cilium from the anterior chamber and the discission of a secondary cataract, in an eye which had been injured eleven years previously. Burnett (Archives of Ophthal., Apr., '92).

Case of epithelial pearl-tumor in the iris following the implantation of an eyelash into the anterior chamber. When first seen, seven months after the injury, the cilium was extracted and an unsuccessful attempt was made to remove the tumor. One year later the growth had increased in size, and the eye was enucleated on account of sympathetic irritation. The tumor, which was surrounded by pigmented iris-tissue, was found to be free from the cornea, ciliary body, and vitreous, and proved to be a cyst lined by laminated epithelium and containing an opaque white substance, composed of fat-globules and polyhedral cells. Cross and Collins (Lancet, July 15, '93).

Case of uveal cysts of the iris in which the diagnosis was made clinically. The condition was seen in an eye with absolute glaucoma resulting from chronic

non-inflammatory glaucoma in a man 40 years old. The masses, two in number, extended into the pupillary space and moved freely. The surface of each was jelly-like and quivering, producing fine creases in the cyst-wall. Microscopical examination corroborated the clinical diagnosis. Eales Birmingham and Sinclair Ipswich (*Lancet*, Feb. 15, '96).

Iridectomy advised for two brownish tumors protruding from behind the outer lower quadrant of both irides. The opinion given that these are uveal cysts, not secondary to malignant neoplasms, and perhaps arising from the anterior border of the ciliary body. M. W. Zimmermann (*Ann. of Ophth.*, July, '97).

GUMMA may develop in the iris, causing one or more rounded swellings, attended with iritis; or in the ciliary body, where it is also attended with inflammation, and may cause ciliary staphyloma either from its primary swelling or by thinning of the overlying sclera by absorption so that it cannot resist intra-ocular pressure. In the iris it usually leaves a thinned and atrophied spot through which may in some cases be seen the fundus-reflex. Active antisymphilitic treatment is indicated.

Rare case observed of gummatous iritis the result of hereditary syphilis, in a female child 7 months old. The anterior chamber was filled by an hæmorrhagic exudate, the iris being almost unrecognizable. Liebrecht (*Zehender's klin. Monats. f. Augenh.*, May, '91).

Two cases of syphilitic gumma of the ciliary body. The tumor passed through the iris angle into the anterior chamber and invaded the iris, which was also the seat of the usual condylomata. In one case there was a perforation of the sclera and conjunctiva through which the most of the broken-down tumor-mass was evacuated. Under treatment the results in both cases were good. Gallenga (*Annal. di Ottal.*, xxv, 2, 3, p. 210).

Differential diagnosis of gumma and sarcoma of ciliary region: first, early iritis, vitreous opacities, perhaps diminished tension, rapid evolution, and bulging of sclera; second, slow non-inflam-

matory onset with glaucoma later; thorough therapeutic test to be made before enucleation. Rochon-Duvigneaud (*Revue Gén. de Clin. et de Thér. Jour. des Prat.*, Apr. 13, '95).

Case of unilateral syphilitic iritis, with typical gumma, occurring in a man 25 years old, three months after chancre of the lip, and preceded by roseola, mucous patches, etc. Cure was apparently obtained after a month's treatment, but a second attack was precipitated by instillation of pilocarpine. The inflammation was ultimately cured without any trace of the affection, vision being absolutely perfect six months after. Armagnac (*Recueil d'Ophtal.*, Mar., '96).

Three cases of gumma of the ciliary body observed in patients 21, 27, and 26 years old. They appeared 2½ years, 6 months, and 2 years after the initial lesion. One preserved a certain degree of sight in spite of scleral perforation. In the other two the globe atrophied. Injections of calomel once a week gives the best results, but they should be combined with inunctions and with injections of the soluble salts of mercury daily. Terson (*Archives d'Ophtal.*, July, '96).

True gumma of the ciliary body that finally yielded to specific treatment witnessed two and a half years after the primary infection. In addition to the signs of syphilitic iritis, there was bulging forward of the iris adjacent to the tumor, producing different depths in the anterior chamber, gummatous growths in the iris, circumscribed discoloration and distinction of the sclera (ciliary staphyloma), and almost total loss of vision from exudation into the vitreous and the pupillary area. H. C. Highet (*Brit. Med. Jour.*, Nov. 7, '96).

OSSIFICATION OF THE CHOROID is often found in eyeballs that have long been blind, and have undergone extensive degenerative changes. It may cause sympathetic irritation, but not inflammation, of the fellow-eye.

SARCOMA may arise primarily in either part of the uveal tract. In the iris it appears as a tumor which grows very slowly, usually brown and deeply pigmented,

sometimes of lighter color, with visible vessels.

The differential diagnosis with the ophthalmoscope between leucosarcoma and melanotic sarcoma can only be made either when the pigment of the hexagonal pigment-layer is absent, as in an albino, or where this layer has been broken through by the growth. Hill Griffith (*Med. Chronicle*, May, '92).

Case of simple melanoma of the iris, with (associated) symptoms simulating simple non-inflammatory glaucoma. The alteration in the color of the left iris had been increasing for a period of seven years and had been accompanied by a gradual loss of vision. The melanosis had partly saturated the sclera also and its vessels. The blood-vessels of the iris were slightly enlarged, but not tortuous. There was a deep glaucomatous excavation of the nerve, and the field of vision was limited to the temporal side. Mullen (*Texas Med. Jour.*, Nov., '96).

Primary sarcoma of the iris may be mistaken for gumma, for simple melanoma, or for primary tubercle of the iris. A simple melanoma becomes darker and darker, while a melanosarcoma ordinarily retains its primary shade. A melanoma is also a congenital growth, while sarcoma is not. Whenever a gumma of the iris appears, there is a severe iritis, whereas in the early stage of sarcoma of the iris there are no inflammatory symptoms. In gumma of the iris there is a specific history, with other symptoms referable to syphilitic infection. The color of the gumma is either an iron-red or deep yellowish red, while that of sarcoma is reddish gray, blackish or light brown, or flesh-color (Andrews). Gumma is non-vascular and yellowish white in color at the summit, but at the base it is vascular and has a yellowish-red border (Fuchs). The administration of anti-syphilitic remedies for a short time in large doses will clear up the diagnosis.

Tubercle of the iris is of much more rapid growth than sarcoma, and in color is of a light yellowish white, or light grayish white, or light grayish yellow (Andrews). As a rule, no vessels are seen on its surface, whereas in sarcoma superficial vascularization can usually be

detected. The larger number of cases of tubercle have occurred in subjects under fifteen years of age, whereas the larger number of cases of sarcoma have been found in older persons. Tubercle is much more irregular in form than sarcoma, and the accompanying inflammatory symptoms also appear earlier. Clarence A. Veasey (*Annal. of Ophth.*, Oct., '97).

Thirty-one cases of diffuse sarcomata of the uveal tract, an extremely rare condition first distinguished by Fuchs in 1882. The most conspicuous feature of the histories is the long duration of the disease in many cases, varying, as shown by the failure of vision, from seven months to ten years. There was a history of injury of or operation in seven cases. Most of the eyes were glaucomatous. These growths are all characterized by their diffuse and infiltrating tendency as opposed to the formation of a definite tumor. Parsons (*Archives of Ophthalmology*, Mar., 1904).

Sarcoma of the ciliary body may first manifest itself in the pupil or by pushing forward the iris; or it becomes adherent to the iris and by its growth drags the iris away from its ciliary attachment, revealing the tumor beneath.

The fourth reported case of melanotic sarcoma of the ciliary body. The tumor involved the ciliary body, extending forward into the anterior chamber, and backward into the centre of the vitreous, 15 by 13.5 millimetres. It was deep brown and light gray in color, and divided by strongly pigmented septa into three small parts and one large portion. Microscopically, it presented the usual features of a mixed-cell, pigmented, choroidal sarcoma. Hirschberg and A. Birnbacher (*Centralb. f. prakt. Augenh.*, Jan., '95).

Case of melanosarcoma of the ciliary body observed in an early stage, associated with apparent iridodialysis. Microscopically the tumor consisted of round and spindle-shaped unpigmented cells extending from the ciliary body. Anteriorly the growth was preceded by an increase in the pigment-cells in the ciliary body, the root of the iris, and the

membrane of Descemet, which gave the clinical appearance of iridodialysis. Pigment-cells were also found between the lamella of the sclera, in the blood-vessels, and even in the peribulbar tissues, showing an early metastasis. Walter (*Archiv f. Augenh.*, B. 31, H. 11, '96).

Sarcoma of the choroid starts as a rounded displacement of the retina, which is not wavy like an ordinary detachment; and through which large vessels may be seen.

Case of hereditary sarcoma of the eyeball in three generations. The left eye of the mother and daughter were affected with melanotic sarcoma, and it was stated that a sister of the mother had died of multiple tumors, and had lost an eye, and that the father and a twin-sister of the first patient had also lost an eye. The nature of the affection was unknown in the last three instances. Silcock (*Brit. Med. Jour.*, May 21, '92).

Microscopical examination of sarcoma of the choroid, arising from injury, made early in its progress, shows that the growth is almost wholly confined to the choroid. Buller (*Trans. Amer. Ophthalm. Soc.*, '95).

From observations based upon the microscopical examination of nine cases of sarcoma of the choroid it is thought that these tumors begin in the vessel-walls and cause an obstruction to the venous circulation, which becomes greater as the vertex veins become involved. As a result of the involvement of the sclera by the tumor the lymph-channels also become blocked. In those cases in which there is greatly-increased tension the arterial lumen is concentrically narrowed. The venous congestion and increases in capillary area produced by the venous obstruction cause an augmented transudation and œdema, especially in the ciliary body, and this is the cause of increased tension. Schlemm's canal remains nearly normal in all instances, but, in cases in which the tension remains low, the surrounding veins become enlarged. In cases of markedly-increased tension the root of the iris is forced against the posterior layer of the cornea, the choroid pressing against the sclera. The tension of the eyes is not dependent upon the

size of the growth, but upon its position. Travis (*Ophthalmic Record*, Apr., '96).

Case of metastatic sarcoma of the choroid which occurred in a man 26 years of age. In this case both the eyes were affected. Examination of one eye showed sarcomatous patches, varying in size, color, etc., the largest and most prominent one lying just below the optic-nerve entrance and apparently including it. The optic nerve seemed to be swollen behind its entrance. Microscopically these patches were found to consist of small round cells, some spindle cells, many blood-vessels, and channels. Examination of the choroid revealed sarcomatous nodules in practically almost all of the viscera. Wiener (*Jour. Amer. Med. Assoc.*, Nov. 8, 1902).

Case of melanosarcoma of the choroid. The patient presented a nodular mass of the left eye which could be seen protruding between the widely opened eyelids. The nodule, which was somewhat mobile, was vascular and pigmented. Its internal surface was covered with numerous scabs, beneath which bleeding areas could be exposed. The skin of the lower lid was excoriated and excreted a thin, sanious fluid. The mass was painless, and the right eye was normal in every respect. The orbital contents were removed and the patient made an uneventful recovery. A very careful microscopical examination of a large number of sections from the removed mass was made. The preponderance of the cells over the intercellular substance (as is usual in such growths), the gross infiltration into the surrounding tissues, and the thorough destruction of all the soft ocular elements are of the utmost importance. The long period of time, possibly more than twenty-six years in this case, that the growth had been in existence and the almost certain surety of the failure of extension or metastasis for a period of more than three years' time after the removal of the orbital mass are of great importance in the prognosis of such an affection. C. A. Oliver (*Univ. Med. Mag.*, Feb., 1901).

Case of metastatic carcinoma of the choroid. Thirty cases collected from literature, including writer's own. The

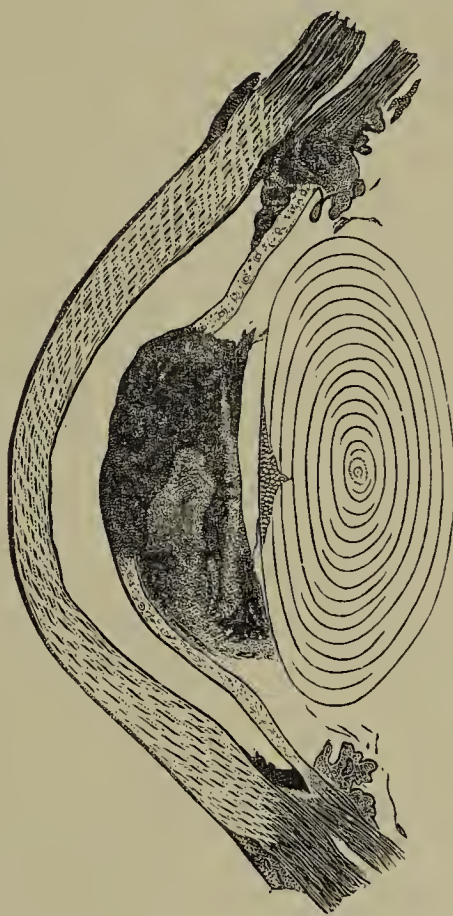
age of the patients ranged from 30 to 58 years; the average was little less than 45 years. Twenty of the primary growths were situated in the breast; one in the thyroid; and one was a dermoid cyst of the suprarenal body. In 2 cases the primary growths were not located. Twenty-two of the patients were females and 7 males. This is probably due to the fact that carcinoma of the breast more readily gives metastasis to the eye. In one of the 7 males the carcinoma was situated in the breast. Metastasis takes place to the eye along the lymph channels. In 10 cases the right eye was involved first, in 9 cases the left eye, and in 10 cases both eyes. In 1 case the side involved is not stated. It is possible that if the patients live long enough both eyes would always be involved. In many cases detachment of the retina occurs very early in the disease, sometimes before the deposit can be seen. The prognosis is bad; the average duration of life after the occurrence of eye symptoms in 24 cases was six and one-half months. The greatest expectation of life is about two years. The first deposit usually occurs near the point at which the short ciliary artery enters the globe, and is a flabby discoid thickening of the choroid with a central elevation of 2 or 3 millimeters. The differential diagnosis is to be made chiefly from sarcoma. E. L. Oatman (Amer. Jour. Med. Sci., Mar., 1903).

For many months or years uveal sarcoma grows slowly, giving rise to no other symptoms; this is its first, or latent, stage. Then it causes increased tension of the eyeball and inflammation; the second, or inflammatory, stage. The third stage begins when it perforates the sclera and begins to invade neighboring tissues. It now grows rapidly. The fourth stage begins with the extension of the disease by metastasis to other organs.

Treatment.—The earliest possible removal of the tumor is indicated. In a few cases of sarcoma of the iris this may

be accomplished by iridectomy, removing the growth with the iris from which it springs. In all other cases the eye must be enucleated, and if perforation of the sclera has occurred the orbit should be emptied of its contents.

If a case of primary sarcoma in the iris be seen in the first stage of the disease, before any signs of surrounding irritation have appeared, it is best to immediately remove the growth by an iridectomy so placed as to include the tumor in the coloboma; whereas, in those cases in



Sarcoma of the iris. (Andrews.)

which the second stage has been reached, enucleation should be performed. Andrews (N. Y. Med. Jour., June 1, '89).

Twenty-four cases of sarcoma of the uveal tract observed in the Göttingen University clinic. In view of the proportion of 37½ per cent. of definite cures personally witnessed, the prognosis does not seem to be so unfavorable as is generally supposed. It is recommended that operation should be done as early as possible. If no recurrence is

noticed within three or four years, the patient is tolerably safe; not absolutely so, however, as was shown in 1 case in which there was recurrence ten years after operation. Freudenthal (*Archiv f. Ophthal.* [Gräfe], Apr., '91).

After-results of 23 enucleations for choroidal sarcoma. Fourteen (over 60 per cent.) were well at periods varying from three to ten years, 6 died of sarcoma of the liver, and the remaining 3 died, but less certainly from extension of the disease. Local recurrence in the orbit took place in 2 cases (8 per cent.). Griffith (*Brit. Med. Jour.*, Sept. 12, '91).

In primary sarcoma of the iris, if the growth is sufficiently small and does not extend to the extreme ciliary portion of the iris, an attempt should be made to remove it by an extremely-broad peripheral iridectomy. If the growth is so large, or is situated so near the ciliary margin of the iris that it is impossible to remove all of it by an iridectomy, or if any other portion of the eye has become secondarily involved, immediate enucleation should be performed. Clarence A. Veasey (*Annals of Ophth.*, Oct., '97).

It has generally been considered that enucleation should be performed early in the disease. The author questions this, unless there is pain or the eye is glaucomatous. The speedy death which, with two exceptions, has followed enucleation (30 cases), raises the expectation that the operation in some inexplicable manner stimulates the other deposits to increased activity. E. L. Oatman (*Amer. Jour. Med. Sci.*, Mar., 1903).

After the third decade of life malignant growths of the choroid become more frequent than earlier. In 25 per cent. of all cases death resulted from metastasis, but the mortality of the operation itself is nil. In about half of personal cases, a cure resulted from operation. The author favors operation of these cases as early as possible. Hirschberg (*Berliner klin. Wochen.*, Feb. 1, 1904).

TUBERCULOSIS OF THE IRIS appears in isolated gray nodules, usually small and scattered throughout the iris, occasion-

ally as a single larger growth. In the choroid the process gives rise to yellowish rounded spots without pigment change; and not attended with symptoms that attract attention, being only discovered with the ophthalmoscope or post-mortem.

Three cases of tuberculous infection of the iris found among 40,000 eye patients. The diagnosis is a difficult one. The disease may readily be mistaken for gummatous iritis or other forms of chronic iritis. It affects children from two to eight years of age, is monocular, and is almost invariably followed by fatal tubercular meningitis. The disease begins with the usual symptoms of plastic iritis. Later, whitish-gray points are found on the posterior surface of the cornea and nodules of tubercle, always vascular, on the surface of the iris. Machek (*Wien. med. Woch.*, June 16, '94).

Tuberculous growths in the iris may be confounded with gumma, sarcoma, and lepra. They may be distinguished from gummata by their color, their predilection for involving the inferior half of the iris, and by the presence of glandular enlargements and the usual signs of pulmonary tuberculosis. A tuberculous nodule may, in its early stages, be confounded with sarcoma, but the latter is almost certain to be solitary, is rarely accompanied by an iritis, seldom occurs before middle life, and is usually more vascular than a tuberculous nodule. In general, it may be stated that the lesion is probably tuberculous when the growths are multiple, non-vascular, and gray, and are accompanied by glandular enlargements. Iritis in a child is generally tuberculous and always serious. C. S. Bull (*Med. Record*, Dec. 8, 1900).

Tuberculous iritis may start in the iris itself or in the ciliary body and the choroid. It spreads very soon from one to the other, involving the entire eyeball, or at least its inner parts. It is usually a secondary affection, but sometimes primary. The author divides it into (1) the solitary form and (2) multiple form. The multiple he also divides into acute and chronic. It is generally a disease of the young or early middle

life and only affects one eye, differing from tuberculous affections of the choid, which attacks both eyes at the same time. In the solitary form the disease assumes a more or less acute stage at once, characterized by the formation of one or more grayish nodules developing on the iris-tissue. It consists of inflammatory products, with a small number of bacilli; is marked by the early appearance of ciliary infection, and is accompanied by intense pain in the eye and forehead. The pain is sometimes so great that enucleation of the eye becomes necessary. In this form there is impairment of vision or destruction of the entire eyeball and not infrequently death, which is brought about by similar simultaneous attacks of the meninges or lungs or by direct extension of the disease to the brain. The multiple form is not so violent in its onset and there are not so many bacilli present in the deposits. This occurs generally in the earlier stages of pulmonary tuberculosis. We find in the iris in this form more than one or two tubercular deposits. There are also pain and photophobia and more or less invasion of the pupillary border of the iris, which in turn leads to the formation of the posterior synechiæ. This form runs a much slower course, and iritis may be relieved entirely if the general condition of the patient improves, or it may result in occlusion of the pupil with eventual shrinking of the eyeball. Mittendorf (Medical News, May 25, 1901).

EDWARD JACKSON,
Denver.

IRON.—Iron, or ferrum, U. S. P., as described by the pharmacopœia, occurs in the pure form of fine, bright, non-elastic wire. From this all official preparations should be made. The official preparations of iron may be arranged in four groups; first, the bland, or those devoid of striking physiological effects, and which may be subdivided into two classes, those soluble in water and those insoluble in water; second, the astrin-

gent; third, the compound, in which another active medicinal agent enters into combination with the iron; and fourth, other official preparations which include those preparations which are seldom used internally or are used for effects other than those properly belonging to iron. A fifth group may be added, embracing some of the non-official preparations of iron which have been found useful and worthy of record. The iron compounds are also known as chalybeates, or martial preparations. Mineral springs containing iron furnish the so-called chalybeate waters.

Preparations and Doses.

I. BLAND PREPARATIONS.

(a) *Soluble in Water.*—Ferri carbonas saccharatus, 2 to 10 grains.

Liquor ferri citratis, 5 to 15 minims.

Ferri citras, 5 to 15 grains.

Ferri et quininæ citras, 3 to 10 grains.

Ferri et quininæ citras solubilis, 3 to 10 grains.

Vinum ferri amarum, 1 to 3 drachms.

Ferri et ammonii citras, 5 to 15 grains.

Ferri et strychninæ citras, 1 to 5 grains.

Vinum ferri citratis, 1 to 2 drachms.

Ferri et ammonii tartras, 10 to 30 grains.

Ferri et potassii tartras, 10 to 30 grains.

Ferri hypophosphis, 5 to 10 grains.

Ferri lactas, 1 to 5 grains.

Syr. hypophosphitum cum ferro, $1\frac{1}{2}$ to 1 $\frac{1}{2}$ drachms.

Ferri phosphas solubilis, 5 to 10 grains.

Syr. ferri quin. et strychninæ phosphatum, $1\frac{1}{2}$ to 1 drachm.

Ferri pyrophosphas solubilis, 2 to 5 grains.

(b) *Insoluble in Water.*

Ferrum reductum, 1 to 5 grains.

Pilulæ ferri carbonatis, 2 to 5 pills.

Mistura ferri composita, $1\frac{1}{2}$ to 2 ounces.

Ferri oxidum hydratum, 1 to 4 drachms.

Trochisci ferri, 1 to 6 troches.

Emplastrum ferri.

Ferri valerianas, $\frac{1}{2}$ to 2 grains.

II. ASTRINGENT PREPARATIONS.—
Liquor ferri acetatis, 2 to 10 minims.

Tinctura ferri chloridi, 5 to 20 minims.

Liquor f. et ammonii acetatis, 2 to 8 drachms.

Liquor ferri nitratis, 5 to 15 minims.

Ferri sulphas, 1 to 5 grains.

Ferri sulphas exsiccatus, $\frac{1}{2}$ to 3 grains.

Pilulæ aloës et ferri, 1 to 3 pills.

Ferri sulphas granulatus, 1 to 5 grains.

Ferri et ammonii sulphas, 5 to 15 grains.

III. COMPOUND PREPARATIONS.—
Ferri iodidum saccharatum, 5 to 15 grains.

Pilulæ ferri iodidi, 1 to 3 pills.

Syrupus ferri iodidi, 10 to 30 minims.

IV. OTHER OFFICIAL PREPARATIONS.—
—Ferri chloridum, styptic.

Liquor ferri chloridi, styptic.

Liquor ferri subsulphatis, styptic.

Liquor ferri tersulphatis—pharmacy.

Ferri oxidum hydratum cum magnesia: antidote to arsenic.

V. NON-OFFICIAL PREPARATIONS.—
Ferratin, 8 to 30 grains.

Ferri arsenas, $\frac{1}{16}$ to $\frac{1}{6}$ grain.

Ferri bromidum, 5 to 20 grains.

Syrupus ferri bromidi, 15 to 60 drops.

Ferropyrin, 8 to 15 grains.

Hæmalbumin, 5 to 15 grains.

Hæmoferrum, 3 grains.

Hæmogallol, 2 to 8 grains.

Hæmoglobin, 75 to 150 grains.

Hæmol, 2 to 8 grains.

Liquor mangano-ferri peptonatus, 2 to 4 drachms.

Physiological Action.—The experiments on the administration of inorganic compounds of iron to guinea-pigs and

other animals, according to A. B. Macallum, have resulted in showing that the intestinal mucosa absorbs these to an extent which varies with the nature of the compound and with the quantity of it given. When the dose is small, absorption occurs only in that part of the intestine adjacent to the pylorus, and measuring only a few inches in length; yet, when the quantity given at any time is large, the absorptive area may embrace the whole of the small intestine. In the former case the result appears to depend on the complete precipitation, as hydroxide, of the iron of the salt unabsorbed, in the thoroughly-mixed chyme, bile, and pancreatic juice; and, in the latter case, the large amount of the iron salt, apparently, first destroys the alkalinity of these fluids, the excess of the salt unaffected and remaining in resolution then undergoing absorption. The intestinal epithelial cells transfer the absorbed iron at once to the underlying elements when the quantity absorbed is small, but with a large amount absorbed the epithelial cells are found to contain some of it. Though some of the subepithelial leucocytes of the villi appear to carry part of the absorbed iron into the general blood-circulation, probably the more important agent in the transference of the inorganic iron from the villi to other parts of the body is the blood-plasma. Marfori's albuminate and the commercial "peptonate" of iron, when administered to guinea-pigs, seem to stimulate the leucocytes to invade the epithelial layer of the intestinal villi. Of the organic iron compounds belonging to the "chromatin" class, that present in egg-yolk (hæmatogen of Bunge) undergoes absorption in the intestine of the guinea-pig and of the *Amblystoma*. In these, but more especially in the latter, after they are fed with egg-yolk for several

days, the cytoplasm of the liver-cells yields marked evidence of the presence of an organic iron compound belonging to the "chromatin" class, and derived from the yelk fed. The mode of absorption of yelk "chromatin" is obscure, but the process appears, in some way, to be connected with the absorption of the fat with which the iron compound is closely associated in yelk.

From carefully-conducted laboratory-experiments, Gaule recently ascertained that not only the organic, but also the inorganic salts, as the chloride, are absorbed. The chloride is absorbed, since, with the organic substances in the stomach, it is changed to an organic substance. Absorption takes place almost exclusively in the duodenum, although in the stomach and small intestine it can be shown to take place. It may also take place through the intestinal epithelium and through the central vessels of the cells; also in similar manner as the fats. Two hours after the entrance of the iron preparation into the intestine there can already be shown in the pulp-cells of the spleen an increased deposition of the so-called iron-reserve. The progress of the iron-absorption is completely normal, and does not result from a disturbance of the normal activity.

The amount of iron excreted by the liver, according to Dastre, is quite variable, but the mean percentage is 0.94 of the dry residue, the hepatic iron depending more on the blood-formation or blood-destruction in the liver than on the alimentary conditions. A dog weighing 55 pounds, eliminates by the bile, in twenty-four hours, $2\frac{1}{2}$ pounds of body-weight.

Microchemical researches on guinea-pigs and other animals showing, by the ammonium-sulphide and bichromate-of-potassium tests, the presence in the intestinal villi and other tissues of an in-

creased amount of iron after ingestion of salts of this metal and organic compounds containing it. Macallum (*Jour. of Physiology*, '94).

The liver is especially rich in iron in pernicious anæmia. Stühlen (*Deutsch. Arch. f. klin. Med.*, p. 248, '95).

Ferric chloride is transformed in the alimentary canal first into ferrous chloride, which combines with albumin to form a soluble product by which the iron is absorbed. Cervello (*Archivio Ital. de Biol.*, xxv, 3).

An iron albuminate passes in a soluble condition into the epithelial cells of the duodenum, and is precipitated in them in the form of granules. It then passes into the central part of the villi and into the mesenteric glands by the aid of lymph-corpuscles. In part it seems to pass in solution in the blood-capillaries. The accumulation of iron in the submucous tissue of the large intestine is connected with its excretion, which is probably effected by the extrusion of iron-laden leucocytes. Hochaus and Quinke (*Archiv f. exp. Path. u. Pharm.*, pp. 159-182, '96).

Experiments made with newborn dogs demonstrating that the presence of iron salts in the food was not immaterial to the formation of hæmoglobin, that there was no absorption of iron salts, and that the liver seemed to regulate absorption in the same way as it did glycogenesis. Cloetta (*Archiv f. exper. Path. u. Pharm.*, '97).

The principal absorption of iron in man is in the duodenum. The iron is stored in the liver and the spleen, and is excreted by the kidney and large intestine. A. Hoffman (*Virchow's Archiv*, 488-512, 151, '98).

Inorganic salts of iron are absorbed in the intestinal tract and exclusively in the duodenum directly into the lymph- or blood- stream through the agency of the epithelial cells, the absolute amount thus absorbed being very small. The absorbed iron is deposited chiefly in the spleen, and partly in the liver and bone-marrow, in the two organs last named probably in organic combinations which do not always permit of its detection, while only the iron which is freed owing

to the extensive disintegration of red cells following anæmia, starvation, etc., is stored in the liver in a loose combination. The excretion of iron occurs in the cæcum, colon, and rectum, and to a much less extent by means of the epithelial cells of the convoluted tubules of the kidneys. The addition of inorganic ferric salts to the food of rabbits increases to a high degree the iron in liver and spleen. The addition of inorganic ferric salts to artificial iron-free food increases considerably the amount of iron in the body, though it does not come up to the amount of normally fed animals, a favorable influence upon the general condition also being noted. The efficiency of inorganic preparations in anæmia is not to be sought in irritation of the hæmatopoietic organs, but probably in a direct action by yielding the iron necessary for the building up of new red cells. H. Landau (*Zeit. f. klin. Med.*, vol. xlii, Nos. 1 to 4, 1902; *Med. News*, Nov. 8, 1902).

In choosing a form of organic iron for internal administration one should be selected which is of definite chemical composition; does not precipitate with a silver nitrate solution; does not give the blue-black color with MacCallum's test; is not decomposed by the hydrochloric acid of the gastric juice, and shows definite results in (a) an increase in the number of red blood-corpuscles and (b) in the amount of contained hæmoglobin. R. W. Wilcox (*American Medicine*, Mar. 12, 1904).

(See also ANÆMIA and ANÆMIA, PER-
NICIOUS.)

Results obtained in a series of experiments performed upon the lower animals shows that iron may act toxically only when it is injected into the blood or hypodermically. The action is chiefly manifested by paralysis of the central nervous system, preceded by a period of irritation. The drug produces death by asphyxia, the result of a direct action on the respiratory centre. When the drug is administered subcutaneously for a long time, inflammatory changes are pro-

duced on the kidneys. The neutral preparations of iron do not produce symptoms of poisoning. (Wojtaszek.)

Iron administered hypodermically remains in the organism as an assimilable substance, producing hyperæmia in various organs and tissues, favoring the absorption of œdema in anæmic patients, the destruction of old red corpuscles, and the formation of new hæmatins. Rocci (Sixth Italian Congress of International Med., Rome; *Univ. Med. Jour.*, p. 366, '95).

As to its effects on metabolism, Stockman found that the quantity of iron in the ordinary daily diet of healthy persons with good appetite averaged from $\frac{1}{8}$ to $\frac{1}{6}$ grain a day. The convalescent diet of the Edinburgh Royal Infirmary, a sufficient maintenance for persons leading a somewhat inactive life, contained $\frac{1}{10}$ grain a day. In the diet of a young lady, living in the ordinary way and taking an average amount of food, $\frac{1}{8}$ grain was found in the daily diet, while in that of two chlorotic girls who ate very little the quantity of iron averaged $\frac{1}{25}$ grain a day (four estimations).

That the iron metabolism of the body must be small is evident; the metal seems to be used over and over again. The total excreted daily by all channels is less than $\frac{1}{10}$ grain a day.

Experiments in regard to the influence which iron exercises over nitrogenous metabolism in the healthy body gave the following results: 1. Iron has no marked influence on nitrogenous metamorphosis in the healthy body. 2. The ingestion of iron in daily doses of 0.3 to 0.5 grain causes a very slight decrease in the assimilation of the nitrogenous portions of the food. 3. After bleeding the assimilation of nitrogenous substances increases a little whether iron is used or not, but if iron is used at this time the hæmoglobin is rapidly reproduced, and the drug would seem to be of value in restoring the bodily weight. Skvortzoff (*Wratsch*, No. 29, '88).

The lowered amount of hæmoglobin and the histological changes of the blood depend not upon the condition of the food, but simply upon the want of iron, since with this one cannot only avoid, but also improve such conditions. Iron given in a form uncombined with organic material is taken up and assimilated by the animal organism. Cappola (Weekly Med. Review, Aug. 2, '90).

Less iron is excreted during the administration of iron than before. This phenomenon is attributed to the retention of the iron by the tissues, and not by the blood. After intravenous injections, a considerable amount of the metal is excreted into the intestinal tract, and, after protracted administration of iron in this manner, the largest amount is found in the liver. Iron, like other metals, accumulates in the liver. Iron is poisonous when injected into the circulation, and not so when given by the mouth, because, in the first instance, the metal does not all reach the liver at once, the part remaining in the blood acting as a deleterious agent; while, in the second instance, the iron is first absorbed by the intestines, then taken to the liver, there retained, and from there enters the system gradually. R. Gottlieb (Zeits. f. phys. Chemie, B. 15, H. 5, '91).

When an animal has been bled, all the organs, especially the liver, are robbed of iron to keep up the supply of hæmoglobin necessary for life. Kunkel (Arch. f. d. Gesamnte Phys., '95).

The kidney is not the means of elimination of iron. Examination of the urine is of value in elucidating the question of the normal disintegration of iron in the economy. Lapique (Archives de Phys. Norm. et Path., No. 2, '95).

Iron is constantly being eliminated both in urine and fæces even during fasting. Raw meat apparently furnishes an available form of iron for absorption under normal conditions. Inorganic iron, as represented by ferrous sulphate, is non-absorbable. Albuminates and peptonates of iron are absorbable, but to a limited extent. Organic iron, of which hæmatin and hæmoglobin are representatives, furnishes the most easily absorbable and most valuable of all iron prepa-

rations. Austin (Boston Med. and Surg. Jour., Mar. 2, '99).

Therapeutics.—The chief indication for the exhibition of iron is the presence of anæmia, a condition in which the hæmoglobin of the blood is present in a less amount than normal. The opposite condition, or plethora, is a contra-indication. The hæmoglobin may be deficient in quantity either from defective or deficient hæmogenesis (formation of blood) or by reason of excessive hæmolysis (destruction or breaking up of the red blood-corpuscles). The best results with iron are obtained in cases belonging to the former class. Since anæmia may be due to various causes,—an insufficient food-supply, an excessive drain or blood-waste from chronic affections, scrofula, tuberculosis, syphilis, or suppurating abscess and other exhausting discharges, or from repeated hæmorrhages, or from the continued action of certain poisons, such as mercury and lead,—it follows that these causes may be grouped into two classes: removable and permanent. In the former class we may expect the best results from ferruginous medication.

There is, notwithstanding the conflicting theories, no reasonable doubt that a part, at least, of the beneficial effect of iron in anæmia is due to its local action upon the digestive organs and especially the stomach.

In cases in which the gastric contents are already too acid during digestion iron accentuates the hyperacidity of the gastric juice and aggravates the dyspeptic symptoms which are usually present in anæmia and chlorosis. In these cases the digestive affection must be set right before iron is administered. In cases, however, in which the secretion of HCl is normal or diminished, iron may often do good service in stimulating the gastric mucous membrane to secretion. Buzdygan (Wien. klin. Woch., No. 31, '97).

There are two indications in the treatment of anæmia: to furnish needed ma-

terial to the blood and to increase primary assimilation of food. The first indication is met with small doses (1 or 2 grains) of reduced iron or of the carbonate; as it has been estimated that the total amount of iron contained in the normal human blood of an adult is only about 39 grains, a large amount cannot be taken up and assimilated by that fluid. Clinical experience has shown that the second indication is best met by the exhibition of the astringent preparations, as the sulphate and chloride, and of these we find that large doses act more certainly and quickly in many cases of anæmia, especially when the tongue is broad, flabby, white (from pallor), and indented on the sides by contact with the teeth. The sulphate is one of the best preparations to increase the appetite and improve the digestion, unless the stomach proves intolerant. When feeble digestion is combined with sluggish intestinal action the addition of aloes as in the pil. aloë et ferri is recommended. Squire's "mist. ferri laxans" also contains a laxative tending to antagonize these untoward conditions:—

℞ Iron sulphate, 2 grains.
Magnesia sulphate, 1 drachm.
Dilute sulphuric acid, 3 minims.
Spirit of chloroform, 20 minims.
Peppermint-water, to make 1 ounce.—M.

If the tongue is heavily coated, the breath offensive, and the bowels constipated, the administration of iron should be preceded by a purge. In some cases, however, even though there be no sign of digestive disorder, the stomach will not tolerate any but the blandest preparations, such as the lactate or the potassio-tartrate, which are the least constipating of the various preparations of iron. When well borne, one of the best preparations of iron is the sulphate. It is generally administered in pill form, with equal parts of potassium car-

bonate. Such a pill is Blaud's. In the anæmia dependent upon malarial poisoning iron may be advantageously combined with quinine or arsenic. The citrate of iron and quinine, or the arsenate of iron—the latter in doses of $\frac{1}{40}$ grain, three or four times daily; the former in doses of 2 to 5 grains thrice daily—may be employed. In the anæmia which is so common an attendant of syphilis an excellent combination is the tincture of the chloride of iron and corrosive sublimate, as in the following prescription:—

℞ Tinct. ferri chloridi, $\frac{1}{2}$ ounce.
Hydrarg. chloridi corros., 1 grain.
Glycerinæ, $\frac{1}{2}$ ounce.
Aquæ, 3 ounces.

M. Sig.: One teaspoonful in water, thrice daily, after meals. In the anæmia of heart disease iron may be combined with digitalis. The two drugs may be given in pill form, in which case the powdered digitalis should be employed; or the tincture of the chloride of iron and the tincture of digitalis may be combined. F. P. Henry (Med. and Surg. Reporter, Apr. 24, '97).

The indiscriminate use of iron as a tonic without attention to the particular indication results in many unsatisfactory effects which are charged to the account of iron. As a hæmatinic it must be recognized as a superior remedy, but it must be given in small doses, so that the degree of irritation shall not exceed that of gentle stimulation. When impaired nutrition is the dominant factor, it may be used in nearly all cases. The addition of nuclein from animal sources is recommended in acute as well as in chronic cases of dyscrasia, thus favoring cell activity. This is especially valuable in cases of catarrh of the mucous membrane, and stress is also laid upon the use of the arsenate in these cases on account of the influence which arsenic has upon systemic metabolism. Attention is called to the exceptional value of iron in combination with zinc as a protoplasmic stimulant. J. Aulde (St. Louis Courier of Med., vol. xxvi, p. 224, 1902).

True organic iron, of which ovoferrin is up to the present time the only rep-

representative, is the most satisfactory form of administering this important element because it is in the exact chemical form for assimilation without change in the alimentary canal. It is not dissociated by the gastric juice into the astringent iron chloride. It does not interfere with digestion, but has a noticeable effect in increasing the appetite. It does not irritate the alimentary canal. Its effect is increasing the red corpuscles, and the hæmoglobin are constant, parallel, and progressive. It has, aside from its blood-forming effect, a demonstrable tonic and reconstructive action which can be explained only by a stimulating influence upon metabolism. R. W. Wilcox (Medical Fortnightly, Jan. 11, 1904).

A remarkable effect of ovoferrin in exciting the appetite. This must be regarded as one of the distinctive and valuable characteristics of the preparation. In virtue of this property ovoferrin possesses a double power of doing good. It directly introduces the required element and in the required form, while at the same time it starts into motion the machinery by which the iron is naturally selected from the food. J. V. Shoemaker (Med. Bulletin, Nov., 1903).

When the stomach rebels against inorganic iron, defibrinated bullock's blood may be given by enema or some of the organic preparations may be administered internally. In simple anæmia, ferratin, in doses of 4 to 8 grains, may be given three times daily in wafers or powder, with milk or other liquid food; children easily take half the dose. Hæmoglobin, the red coloring matter of the blood, occurs as a brownish-red powder, which may be given in doses of 25 to 50 grains, in wine or syrup, three times daily. Hæmogallol, a preparation made from hæmoglobin, may be given in doses of 4 to 8 grains, three times daily, a half-hour before meals, in powder with sugar, or in wafers, pills, or tablets. Hæmol, also from hæmoglobin, is given in the

same manner as the preceding, in doses of 4 to 8 grains. Hæmoferrum is another preparation derived from bullock's blood; it is given in doses of 3 grains.

Another organic preparation that has found large use is liquor mangano-ferri peptonatus, or "pepto-mangan," a bland liquid, usually well borne by the stomach in doses of $\frac{1}{2}$ to 1 tablespoonful three times daily.

Care should be taken not to associate ferratin too closely with acid. Marfori (Annali di Chim. e di Farm., Feb. 1, '94).

The daily amount of iron required is about 50 grains. Iron is supplied by vegetable foods of various kinds, and perhaps in sufficient quantity for the needs of a healthy person, but not enough for one suffering with anæmia. A larger quantity is furnished by animal food, particularly milk, eggs, liver, and blood. The combinations in the first three are stable, and therefore not so serviceable as those found in the last. Certain iron-containing derivatives of blood may be used with success in anæmia. Of such, hæmol and hæmogallol are particularly useful. In addition there are certain artificial products having definite value, among which is rated ferratin. Kobert (Deutsch med. Woch., July 12, 19, '94).

To small children ferratin is given in milk or other liquid foods, and it is found to be an excellent nourishment and one especially indicated for such children as are deprived of their mother's milk and do not thrive well on the artificial products. G. T. Richardson (N. Y. Med. Jour., Apr. 18, '96).

Ferratin tried for specific blood-making effect in six cases confined in the Cagliari Clinic, and in five day-patients at their dispensary. Daily record kept of all details, including blood-corpuscle count by Thoma-Zeiss apparatus and hæmoglobin estimation by the chromocitometer of Bizzozero. From this report are quoted the conclusions:—

Case 1. December 27th, 30 per cent. hæmoglobin; red corpuscles per cubic centimetre, 3,000,000; weight, 115 pounds.

Ten weeks later, 55 per cent. hæmo-

globin; 4,000,000 corpuseles; weight, 122 pounds.

Case 2. December 21st, 28 per cent. hæmoglobin; 2,800,000 corpuseles; weight, 108 pounds.

Eight weeks later, 55 per cent. hæmoglobin; 4,000,000 corpuseles; weight, 127 pounds.

Case 3. January 27th, 60 per cent. hæmoglobin; 4,000,000 corpuseles; weight, 147 pounds.

Three weeks later, 85 per cent. hæmoglobin; 5,000,000 corpuseles; weight, 154½ pounds.

Case 4. February 18th, 20 per cent. hæmoglobin; 2,000,000 corpuseles; weight, 84 pounds.

Nine weeks later, 55 per cent. hæmoglobin; 4,000,000 corpuseles; weight, 84½ pounds.

Case 5. April 2d, 45 per cent. hæmoglobin; 3,600,000 corpuseles; weight, 102½ pounds.

Ten weeks later, 65 per cent. hæmoglobin; 4,000,000 corpuseles; weight, 116½ pounds. A. Varese (*Annali di Farm. e Chim.*, July, '98).

Iron acts in anæmia by stimulating the blood-forming process in the bone-marrow, and not by merely supplying the iron necessary to the formation of an increased amount of hæmoglobin. When administered by the stomach it is absorbed, and is found in large quantities in the bone-marrow, as well as in the liver and spleen. In animals rendered anæmic by bleeding the erythrocytes were rapidly formed and came sooner to maturity, so that a larger number of them enter the circulation in a given time. In young healthy rabbits the bone-marrow became deep red when iron was given. A. Hofmann (*Virchow's Archiv*, B. 160, S. 235-306, 1900).

Series of 12 cases in which daily injections of 1 cubic centimetre (15 minims) of a 10-per-cent. solution of ammonio-citrate of iron were used. Unpleasant symptoms sometimes set in after the lapse of a few minutes to half an hour—namely, a sense of general heat, severe headache, vertigo, debility, sometimes an epigastric oppression and a feeling of œsophageal constriction, followed in most cases by vomiting.

These symptoms often occur at the beginning of the treatment, and then disappear, only to return when the organism is saturated with iron; but in this latter case they can often be prevented by lengthening the interval between the injections. Avoiding these liabilities to error, the author found that the locality of the injection had a very marked influence on the occurrence of the unpleasant symptoms. They occurred in greater or less degree after 51 out of 54 injections (94.4 per cent.) in the dorsal region, but only in 17 out of 305 injections (5.3 per cent.) made in the gluteal region. A. Plessi (*Gazz. degli Osped.*, July 7, 1901).

In chlorosis the use of iron does not yield as good or as certain results as in anæmia; in fact, some cases are not benefited at all by iron alone, but yield to a combination of iron and strychnine, or iron and arsenic.

It has been found by clinical experience that the long-continued use of iron may lead to impairment of digestion, headache, and other functional troubles. It is well, therefore, to make occasional intermissions and to give a purge meanwhile. It has also been found that good food, fresh air, and out-door exercise favor the assimilation of iron, although in some cases of profound anæmia absolute rest in bed has been found to hasten recovery.

HYPODERMIC USES.—This mode of administration is especially indicated in cases of anæmia requiring rapid results and when the remedy is not well borne by the stomach. The citrate is generally preferred for this purpose, the dose being one-half that given by the mouth.

Iron, hypodermically injected, is effective in nervous affections. Two preparations recommended: one is peptonized iron, soluble in water. A solution of this is made of the strength of 1 to 10. The second is ferrum oleatum, diluted in the proportion of 1 to 20 of olive-oil. Both preparations are employed in doses of 1

syringeful every second day. Subcutaneous iron treatment especially recommended in neurasthenic persons and in asthenic dyspepsia often associated with anæmia. No disagreeable after-effects. Rosenthal (Provincial Med. Jour., Sept., '91).

Iron administered hypodermically very useful in certain forms of anæmia when a rapid effect is desired, or when iron is not tolerated by the alimentary canal. Ferrous manganese citrate, made by Merck, gives the best results. The solutions are made thus: The crystals are powdered in a mortar and gradually dissolved in hot distilled water, 1 grain of the crystals to 5 minims of water. The usual dose for an adult is 15 minims, representing 3 grains of the compound salt. The dose of iron for hypodermic use should not, to begin with, be more than one-half of what is given by the mouth. Da Costa (Ther. Gaz., May 15, '96).

In the cases where the stomach is intolerant of iron, it must be given hypodermically. The citrate of iron is as good as, if not superior to, any other preparation for the purpose. It appears in the urine half an hour after the injection, and is present for twenty-four hours, the maximum excretion taking place two to four hours after. Gloevecke and others have had good results by injecting a 10-per-cent. solution into the buttocks or muscles of the back, using 15 minims at a time. The injection causes a sharp pain, which lasts for some time, but that by using a larger quantity (38 minims) of a weaker solution (4 per cent.), this inconvenience disappears and there is only slight tenderness.

A little over 45 grains of the citrate when injected has produced vomiting, fever, and *malaise*, lasting several hours. Great caution is required if the kidneys are unsound, since even if they are healthy too concentrated injections may lead, not only to the usual harmless polyuria, but to anuria and even hæmaturia and nephritis. The treatment is altogether contra-indicated in anæmic patients suffering from hepatic cirrhosis, epistaxis, hæmorrhoids, metrorrhagia, etc., since it predisposes to hæmorrhages. Lépine (Sem. Méd., May 26, '97).

By means of intravenous injections of iron it is possible to increase the hæmoglobin 50 per cent. The method is devoid of danger and certain in its results. F. Aporti (Gaz. degli Osped. e delle Cliniche, No. 131, '99).

Cacodylate of iron is very soluble and may be administered hypodermically or by the mouth; its toxicity is very slight, and it may be employed in all cases in which it is desirable to increase not only the number of red blood-cells, but also the amount of hæmoglobin. The dose to be employed hypodermically is $\frac{1}{2}$ to $\frac{3}{4}$ grain daily, by the mouth, 1 to 2 grains or more a day. Gilbert and Lereboullet (Jour. des Praticiens, Sept. 1, 1900).

MALARIA.—The anæmia of malarial poisoning is benefited by administration of iron. If the spleen is enlarged and the portal circulation engorged, a purge of compound jalap powder should precede the administration of the iron, or podophyllin should be combined with it.

The ferrocyanide of iron, or Prussian blue, possesses excellent antiperiodic properties. It is administered generally in 5-grain doses every three hours. The remedy is also a good tonic. Schussler (Chicago Med. Times, Aug., '91).

Of five cases of malarial cachexia treated with hypodermic injections of citrate of iron, four cases recovered completely. The fifth was greatly improved. Naame (Rev. de Méd. de Paris, Mar. 10, '97).

PSEUDOLEUKÆMIA.—In leucocythæmia iron is of little service, but in pseudoleucocythæmia (Hodgkin's disease, or splenic cachexia) it is highly useful.

In series of cases of leukæmia and pernicious anæmia was 1 case in which the patient improved markedly under the use of arsenic and iron sulphate, the red corpuscles increasing from 886,000 to 4,360,000 during one period of the treatment. H. A. Hare (Med. News, Mar. 27, '97).

VENEREAL DISORDERS.—In the anæmia of syphilis the use of the iodide of iron is indicated.

In sloughing phagedena or chancroid, the anæmia incident to those affections is best treated by the iodide of iron, although many prefer the tartrate of iron and potash.

Twenty-five cases of spermatorrhœa treated with ferric bromide. Of this number 19 were completely cured, 2 only being unrelieved. The dose is 3 to 5 grains given either in solution or in the form of a lozenge. The ferric bromide is to be preferred to the corresponding ferrous compound. Hecquet (*Ther. Gaz.*, Feb., '91).

RHEUMATISM.—Though not very often used, in acute rheumatism the tincture of the chloride in doses of 20 to 30 minims, well diluted, every four hours, will diminish the pain, fever, and sweating and lessen the danger of cardiac mischief. It will hasten convalescence and may, moreover, be used as a prophylactic against acute rheumatism in weak and cachectic subjects (Anstie), but not in the robust or full-blooded (Bartholow).

The succinate (hydrated) of iron is the most palatable preparation of iron. The tasteless succinate, in combination with an elixir, is permanent under all circumstances. Combined with syrup trifolium compound, the succinate of iron will be found without a rival in the treatment of rheumatism and the various forms of syphilis. It is similarly useful for the anæmia of chronic malarial poisoning, and is indicated in the treatment of erysipelas, pulmonary hæmorrhage, hæmorrhage of the bowels, and other intestinal disorders. It should be given in small quantities at the beginning, gradually increasing the dose. William Thornton Parker (*Med. Age*, Dec. 26, '91).

ERYSIPELAS.—The treatment by iron is not new, but it is for that reason none the less satisfactory. Large doses—10 to 60 minims—of the tincture of the chloride, well diluted, may be given every four hours with advantage.

Iron takes into the blood the oxygen required, which, coming in direct contact with the streptococci of erysipelas, causes

their destruction. If iron be given all the time in this disease, and the patient placed in an aërated chamber where oxygen may be generated, the records would show a considerable decrease in mortality from erysipelas and kindred affections. J. A. Crisler (*Memphis Med. Monthly*, Apr., '90).

Bromide of iron believed to be one of the best preparations for internal administration, as it is easily and quickly assimilated. It is especially valuable as a topical application, in fœtid discharges and gangrenous ulcers. In erysipelas it acts as a specific. In such cases it must be freely used, painted over and beyond the infected integument. Gillespie (*Pacific Record of Med. and Surg.*, July 15, '90).

DIPHTHERIA.—The tincture of the chloride is given internally to support the organism, either alone or combined with chlorate of potash, quinine, or strychnine. The use of the chlorate of potash in this disease is, however, objected to on the ground that it induces destructive changes in the renal tissue. Monsel's solution (liq. ferri subsulphatis) may be used locally upon the tonsils and pharynx, either pure or diluted with two or three parts of glycerin. It constricts the tissues and appears to limit the extension of the exudate. This latter application may be used in the same manner in follicular tonsillitis with advantage.

Value of perchloride of iron in preventing the spread of diphtheria from the pharynx to the larynx. The 2-per-cent. perchloride in glycerin is given hourly, night and day, in teaspoonful or dessert-spoonful doses. N. Rosenthal (*Ther. Monats.*, Dec., '92).

Application of perchloride of iron in diphtheria made twice daily if the cases be light, and three times daily if they be serious. The drug is used either in a pure state or in one-half or one-fifth solution. The healthy adjoining tissue is not injured by the treatment. T. Huebner (*Ther. Monats.*, Dec., '92).

Applications of pure perchloride of iron

recommended in pharyngeal diphtheria. The suffering which the applications cause is most intense, but three or four are sufficient to vanquish the disease. Of thirty-six cases personally treated there was but one death: from enormous ganglionic tumefaction. Feige (*Ther. Monats.*, July, '94).

SCROFULOSIS.—In scrofulous adenitis and rachitis the syrup of the iodide is beneficial. It is best to begin with small doses, gradually increasing the same as tolerance is established. The combination of the phosphates of iron and lime are preferred by some in rachitis. Cod-liver-oil given with iron increases the efficiency of the former in these cases.

NEUROSES.—Neuralgia due to anæmia is greatly benefited by large doses (30 to 40 minims) of the tincture of the chloride or by 20 grains of the saccharated carbonate, given three times daily. Ferropyrin, one of the newer preparations, may be given in doses of 4 to 8 grains in these cases.

In the anæmic forms of mental diseases Bucknill and Tuke advised the administration of the tincture of the chloride of iron.

In hysteria associated with anæmia the valerianate of iron may be given in pill in doses of 1 to 5 grains, three times daily. Amenorrhœa and other derangements of the menstrual function dependent upon anæmia are benefited by the citrate of iron alone or combined with strychnine.

A great many cases of dysmenorrhœa occur in anæmic young women, and full doses of iron will cure the anæmia and with it the dysmenorrhœa. I. Parsons (*Brit. Med. Jour.*, Oct. 24, '96).

In epilepsy and chorea in weak and anæmic pupils the use of the bromide of iron is recommended by Da Costa, the bromide in doses of 5 to 20 grains or, preferably, the syrup of the bromide in doses of $\frac{1}{2}$ to 1 teaspoonful.

PULMONARY DISORDERS.—When there is anæmia the bland preparation seems to agree best. Iron is, however, contra-indicated when pulmonary hæmorrhage exists or threatens and in all acute pulmonary affections.

Hectic fever is controlled by a combination of digitalis and iron: 5 drops of the tincture of digitalis may be given with 10 drops of the tincture of the chloride of iron, three or four times daily.

CARDIAC DISEASES.—In the various cardiac affections the administration of iron is generally beneficial. In fatty degeneration of the heart iron does good by improving the nutrition of the organ. The palpitation, murmur, and præcordial distress of anæmia and chlorosis are relieved by iron. When the cavities, especially on the right side, are dilated, and cough, dyspnœa, and dropsy are present, iron often affords greater relief than cardiac sedatives and diuretics (Bartholow). In these cases and in mitral regurgitation, as the distress is increased by the thinness of the blood, Bartholow advises the following pill, three times daily: Reduced iron, quinine sulphate, and powdered digitalis (English), of each, 1 grain; powdered squill, $\frac{1}{2}$ grain. In valvular lesions iron may be used if anæmia be present. Plethora interdicts its use.

RENAL DISEASES.—In this class of affections iron should be given with prudence, especially in chronic nephritis.

In chronic albuminuria the tincture of the chloride improves the digestion and counteracts the anæmia. Many prefer Basham's mixture (liquor ferri et ammonii acetatis), 2 to 4 drachms three or four times daily, on account of its diuretic action.

There is a good deal of mischief done by iron in Bright's disease. Basham's mixture in Bright's disease was never suggested for any directly curative pur-

pose, but simply as a remedy for the anæmia which is so conspicuous a symptom in many cases, and for this purpose it still is and always will be useful. But not every case of Bright's disease is anæmic, and as iron has no specific curative effect it is clearly not indicated in non-anæmic cases. Nay, more, it is often harmful. It may be laid down as a rule to which there is almost no exception that iron is not indicated and should not be prescribed in cases of acute Bright's disease. On the other hand, after the acute symptoms have passed away and convalescence sets in, iron is often very useful.

A second class of cases in which iron is contra-indicated is chronic interstitial nephritis, in which it is more promptly and dangerously harmful than in any other form known of Bright's disease.

The form of Bright's disease in which iron is best borne is chronic parenchymatous nephritis. And as this is apt to be associated with more or less anæmia, it becomes a most valuable remedy in overcoming this symptom. Even here the doses given are usually needlessly large. The author's practice is to determine the proper dose by an examination of the stools, and, if these are decidedly blackened, too much is being given. On the other hand, a slight coloration may be permitted. Basham's mixture is no more diuretic than the bulk of water which constitutes its menstruum. James Tyson (*Jour. Amer. Med. Assoc.*, July 23, '98).

HÆMORRHAGE.—The astringent preparations of iron are useful in hæmorrhage. In the passive hæmorrhages (purpura; hæmorrhagic diathesis; gastric, intestinal and renal hæmorrhage when due to anæmia) the tincture of the chloride, taken internally, improves the tone of the vessels and the quality of the blood.

Iron-quinine chloride is exceedingly useful in cases of post-abortum hæmorrhages, in doses of 10 drops, every one or two hours, of a 10-per-cent. solution. It is likewise of value in cases of pulmonary hæmorrhage, and in profuse menstruation, in doses of 10 drops five or six times

a day. J. Kersch (*Pharm. Post*, Mar. 1, '91).

Persulphate of iron, combined with inhalations of oxygen and careful hygienic regulations, most useful in treatment of hæmoglobinuria. Baccelli (*Gaz. degli Osped. e delle Clin.*, Feb. 15, '97).

Ferratin has had a limited, but successful, trial in the New Haven Hospital. It has been used in secondary anæmias due to hæmorrhage following childbirth, etc. In primary anæmia it has been used very little. The results have usually been prompt and satisfactory. Hospital and Clinic Notes (*Yale Med. Jour.*, June, '98).

In epistaxis and chronic coryza a weak dilution of the liquor ferri subsulphate (1 drachm to 8 ounces of water) has been advised, to be used in spray. The same application has been used in pulmonary hæmorrhage. As it stains the teeth, its use is objectionable.

Ferripyrin, a new hæmostatic, is a combination of perchloride of iron and antipyrine. It is a very fine orange-colored powder, soluble in water, the solution being deep red in color. It is intended as a substitute for perchloride of iron, and the indications for its use are the same. The dose for an adult is $7\frac{3}{4}$ grains internally, mixed with an oily, sweet preparation of menthol. It is of value in gastrorrhagias. For external use and as an hæmostatic, either the powder or an 18- to 20-per-cent. solution may be employed, cotton tampons being saturated in the solution and applied to the bleeding surface. In 1- and $1\frac{1}{2}$ -per-cent. solutions it is recommended as an astringent in urethral blennorrhagia. Epistaxis in a case of nasal myoma was arrested in a very short time by the introduction of two small tampons soaked in ferripyrin. The drug is free from the caustic effects produced by perchloride of iron. L. Hedderich (*Münch. med. Woch.*, No. 1, '95).

In hæmatemesis, 1 or 10 drops of the solution of the subsulphate, or pernitrate, well diluted in ice-water, will generally be followed by relief. The tincture of the chloride may be similarly used.

In intestinal hæmorrhage iron is less

beneficial, as it becomes converted into the inert sulphide as it descends the alimentary canal.

LOCAL USES.—The bleedings from hæmorrhoids may be diminished, or even arrested, by bathing the protruding tumors with Monsel's solution. The tumors should be well oiled before returning them. The hæmorrhage from leech-bites and after the extraction of teeth, and the oozing from surface in minor surgical operations may be arrested by the application of Monsel's salt or solution combined with pressure, when

possible. Fissured nipples may be healed by brushing the fissures with Monsel's solution diluted with three parts of glycerin. Syphilitic vegetations of the glans and prepuce will disappear under applications of pure Monsel solution; *Ascarides vermiculares* may be removed by injections of weak dilutions of the tincture, and, as anæmia is usually present in these cases, the internal use of iron is advised.

C. SUMNER WITHERSTINE,
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ITCH. See SCABIES.

J

JABORANDI.—Jaborandi (Pilocarpus, U. S. P.) is the dried leaflets of the South America trees *Pilocarpus sellvanus* (Rio Janeiro jaborandi) and *Pilocarpus jaborandi* (Pernambuco jaborandi), belonging to the family *Rutaceæ*. The leaflets have an aromatic odor, and an aromatic, bitter, and pungent taste. When chewed they produce an increased flow of saliva. Jaborandi contains two alkaloids (pilocarpine and jaborine), a volatile oil, jaboric acid, and tannin. Chemically the two alkaloids are similar. The physiological actions of the two alkaloids are widely different. The alkaloid pilocarpine is non-crystallizable, and occurs as a colorless or yellow syrupy liquid, which is soluble in water, alcohol, ether, and chloroform. The salts of pilocarpine are crystallizable. The hydrochlorate is official and occurs in white, hygroscopic crystals, of a slightly-bitter taste and of an acid reaction; it is soluble in water and alcohol, and does not keep well.

A preparation of pilocarpine previously active may suddenly lose all its power. H. Magnus (Ther. Monats., Feb., '88).

Jaborine is never used in medicine, and has an effect antagonistic to pilocarpine, or like atropine.

Preparations and Doses.—Pilocarpus, 5 to 50 grains.

Extract or extractum pilocarpi fluidum, 10 to 60 minims.

The hydrochlorate of pilocarpine (pilocarpinæ hydrochloras), $\frac{1}{8}$ to $\frac{1}{2}$ grain.

The existence of a base isomeric with pilocarpine, produced from it by the action of heat or alkali, as first noted by Petit and Polonowsky, is confirmed. These investigators gave it the name of pilocarpidine, but this should be retained for a base found in jaborandi leaves, which has been partly described by Harnack and Merck. As the new alkaloid is isomeric with pilocarpine and easily formed from it, the author suggests that it should be called "isopilocarpine." Its presence is proved as an impurity in the pilocarpine nitrate at present on the market, and in the alkaloid prepared from jaborandi leaves at present obtainable. His experiments also show that it exists ready formed in the leaves. The existence of the pilocarpidine of Harnack and Merck and their statements regarding

its composition are confirmed from an examination of some of the nitrate obtained from Merck. But the author proved that the jaborandi leaves at present on the market, consisting chiefly of *Pilocarpus microphyllus*, and the pilocarpine nitrate of commerce contain no pilocarpidine. The jaborine described by Harnack and Meyer as an alkaloid existing in the mother-liquors of pilocarpine is shown to be a mixture of pilocarpidine, isopilocarpine, with possibly a trace of pilocarpine and coloring matter. No alkaloid answering to the description of jaborine could be found in the leaves at present obtainable. Physiological experiments confirm the results of the chemical investigation with respect to the nature of jaborine. Preliminary physiological experiments on isopilocarpine, pilocarpine, and pilocarpidine have been made by C. R. Marshall, of University College, Dundee, who reports that the substances produce similar effects on the secretory activity of the sweat and salivary glands, pilocarpine being much the most powerful. Isopilocarpine is comparatively less depressant to the hearts of rabbits, but not to those of cats or man. The jaborine of Merck possesses a mild pilocarpine effect. H. A. D. Jowett (Trans. Chem. Soc., 1900; Brit. Med. Jour., Jan. 19, 1901).

Jaborandi leaves contain three alkaloids. Isopilocarpine only occurs in small quantities, and pilocarpine only in small amounts in *pilocarpus jaborandi* Holmes. No substance corresponding to jaborini has been found in the leaves, either chemically or physiologically; but a substance possessing an atropine-like action is present in the jaborine of Merck, which, however, consists mainly of pilocarpine or isopilocarpine. Isopilocarpine acts like a weak pilocarpine. In efficient doses it is about six times weaker. In large doses it is about twenty times weaker. Pilocarpine is still weaker than isopilocarpine. The homopilopic portion of the pilocarpine molecule acts at least as an interacting to haptophore group. Solutions containing the hydroxy-acid corresponding to the lactone-pilocarpine are inactive.

The influence of the glycosaline part of the molecule has not yet been determined. C. R. Marshall (Jour. of Physiol., May 3, 1904).

Physiological Action.—A medicinal dose of jaborandi causes flushing of the face and neck, followed by profuse sweating of the entire surface, marked salivation, and occasionally nausea. In some subjects, and particularly in children, even large doses produce no effect.

Toxic doses cause depression of the nerve-centres, but normal doses seem to slightly, if at all, influence the nervous system. The pulse of animals is slowed by jaborandi; but this does not seem to be the case in man, in which, on the contrary, the pulsations are increased in number. The temperature is markedly lowered after a rise of short duration.

Pilocarpine, according to Reichert, first increases and then decreases bodily temperature. Heat-production and heat-dissipation are first increased and then diminished. The alterations in temperature are dependent essentially upon the actions on heat-production, but may be affected by sweating, and, after very large doses, by alterations in heat-dissipation. The primary increase of temperature is due at first to an increase of heat-production, but after very large doses this increase may be exaggerated and continued by a diminution of heat-dissipation which is greater than the depression of heat-production. The actions on the process of heat-production are so much more potent in their effects on temperature than those on the sweat-glands that it is doubtful if the latter ever play an important part in the temperature-alterations. Bodily temperature may be increased during the stage of diminished heat-production, owing to the great depression of heat-dissipation. The amount of increase and decrease of temperature and the duration of each

of these periods are essentially in direct relation to the dose.

Horbaczewski found that pilocarpine caused an increase in the number of leucocytes in the blood and a correlative increase in the quantity of uric acid. The excretion of urea is markedly increased.

The influence of jaborandi upon the renal system differs with the dose administered. Large doses, by diminishing the body-liquids through the profuse sweating induced, decrease the quantity of urine; small doses increase the flow.

As to the direct cause of the sweating, it is thought to depend upon stimulation of nerve-ends of the sweat-glands and upon paralysis of the vasomotor nerves, as would naturally be inferred.

Poisoning by Jaborandi or Pilocarpine.—Serious and even fatal results have followed the injection of medicinal doses of pilocarpine; $\frac{1}{3}$ grain of pilocarpine has caused profuse diaphoresis, salivation, lacrymation, a discharge from the nose, sickness of the stomach, difficulty in breathing, and a sense of cardiac oppression. Rémy mentions a case in which the remedy induced a series of epileptic attacks. In another case the patient suddenly expired directly after an injection had been made. The use of lethal doses is usually followed by copious sweating, dizziness, salivation and swelling of the salivary glands and tonsils, lacrymation, discharge from the nose, hiccough and strangling, vomiting, diarrhœa, a tearing pain in the eyeballs, myopia, dimness of vision, strongly-contracted pupils, dyspnœa, and more or less cardiac oppression, and sometimes bloody leucorrhœa is seen. These effects and the report of occasional cases of accident following the administrations of medicinal doses should teach caution in the use of the remedy.

Caution advised in the use of what may prove a dangerous drug, as fatal or alarming symptoms may be produced by pilocarpine. Lanphear (Kansas City Med. Index, Nov., '88).

Treatment of Poisoning by Jaborandi.

—The untoward symptoms of poisoning by jaborandi indicate the use of active external and internal stimulation. If taken by the mouth, use emetics or a stomach-siphon to wash out any portion of the drug that may be present in the stomach. Atropine or any preparation of belladonna may be used as a physiological antidote. Ammonia and brandy should be given freely. The vomiting may be controlled by morphine.

Therapeutics.—The therapeutics of jaborandi accord strictly with its physiological action, for it is mainly employed for its property of producing sweating. As it is the most powerful remedy we possess for this purpose, it should be used with great caution, as it is much more depressing than the use of the hot-air bath, water packs, etc.; it should not be used in cases of asthenia or adynamia, or in pronounced embarrassment from organic diseases, pulmonary congestion or œdema, threatening or existing, or in irritation or inflammation of the alimentary canal.

URÆMIA AND NEPHRITIS.—Pilocarpine is generally to be preferred to jaborandi, as it is less likely to produce nausea and vomiting.

Jaborandi and its alkaloid, pilocarpine, are agents that are extremely useful in uræmia, fever, desquamation, or chronic parenchymatous nephritis, since they markedly increase the elimination of urea by the skin; lower the blood-pressure, and diminish the inflammatory condition. In acute scarlatinal nephritis pilocarpine is of the greatest service, increasing the urinary secretion and decreasing the albumin and the blood.

Shoemaker suggests the following formula:—

R Extract of jaborandi, $\frac{1}{2}$ fluid-ounce.

Solution of potassium citrate, 2 fluidounces.

Syrup of orange, 1 $\frac{1}{2}$ fluidounces.

Mix and give a teaspoonful or two every three or four hours.

Cardiac depression may be avoided by the exhibition of strychnine and alcohol. In the uræmia of pregnancy and puerperal eclampsia the hypodermic injection of pilocarpine may be of marked benefit, but in some cases it does more harm than good by its depressing influence. In the nephritis of middle and advanced life, many authorities consider that pilocarpine is contra-indicated. As a renal stimulant pilocarpine may be given in doses of $\frac{1}{30}$ to $\frac{1}{20}$ grain, either by hypodermic injection or by the mouth.

PASSIVE EFFUSIONS.—Pilocarpine has been used in dropsy, ascites, and hydrothorax. In dropsy of renal origin it is a valuable agent, but when due to cardiac trouble it is too depressing. In hydrothorax it is of considerable value, but thoracentesis is, perhaps, best, and elaterium or salines come next in efficiency.

ERYSIPELAS.—Da Costa reports success from the use of pilocarpine in acute erysipelas. He recommends the hypodermic administration of $\frac{1}{6}$ grain every three hours until free sweating ensues, then every four to six hours. Its action is so prompt and effective that it may almost be regarded as a specific. The diaphoresis is at once followed by the retrocession of the rash, and an improvement in the general condition. In atonic cases, when the heart is weak and perspiration cannot be established by pilocarpine no beneficial action is observed (Waugh).

Hypodermic injections of pilocarpine

recommended in facial erysipelas. Twenty-four cases treated in this manner, all severe, 20 presenting albuminuria and 4 retention of urine. The drug must be administered until the physiological effects are produced. Recovery took place in all his cases within eight days at latest, and in some cases in four days. Pilocarpine is contra-indicated in affections of the heart. If the erysipelas appear as a complication, the treatment is absolutely without efficacy. Salinger (Ther. Gaz., Mar. 15, '94).

Good results with the drug in erysipelas; its efficacy probably depends on the time which has elapsed from the inception of the first symptoms before treatment is begun. In cases seen very early success is almost invariable. G. W. Barr (Ther. Gaz., May 15, '94).

FEVERS.—A dose of pilocarpine will generally succeed in aborting a malarial chill. It should not be used in asthenia.

ACUTE CONGESTION.—In the acute congestive conditions following fevers or exposure to cold—coryza, bronchitis, laryngitis, muscular or articular rheumatism, and similar affections—pilocarpine may be used with benefit in the early stage. Small doses of pilocarpine followed by quinine are, perhaps, as efficient as large doses and, withal, safer.

In parotitis (mumps) the relief from pilocarpine is prompt when given early.

CHRONIC AFFECTIONS.—Chronic rheumatic disorders and sciatica have been ameliorated by diaphoretic doses of pilocarpine.

In a patient who suffered from two or three attacks of rheumatism yearly, the writer used hypodermic injections of pilocarpine, using $\frac{1}{6}$ grain, which led to complete recovery within six days. Drapier (Jour. des Sci. Méd. de Lille, Sept. 15, '94).

The fulgorant pains of locomotor ataxia may sometimes be relieved by subcutaneous injections of pilocarpine. Mitkowski has tried pilocarpine in persistent catarrhal jaundice with great benefit, in the hypodermic dose of $\frac{1}{6}$.

grain every other day for three weeks. He attributes, moreover, a diagnostic value to the procedure. If the above treatment produces no effect upon the jaundice, the presence of a malignant growth is to be suspected.

In laryngitis with scanty secretion J. Solis-Cohen suggests the use of from 1 to 5 minims of the fluid extract of jaborandi to 1 ounce of water, in spray locally.

Pilocarpine is a specific for croup and all croupous diseases. Its action begins at once. The drug can be given by the mouth, subcutaneously, or in suppository. The duration of the disease is notably shortened by the use of pilocarpine and the mortality reduced to *nil*. The daily doses advised are as follow: Up to 1 year, $\frac{1}{6}$ to $\frac{1}{3}$ grain; 1 to 3 years, $\frac{1}{3}$ to $\frac{1}{2}$ grain; 3 to 6 years, $\frac{2}{3}$ grain; 6 to 10 years, $\frac{7}{8}$ grain; 10 to 15 years, 1 to $1\frac{1}{8}$ grains; adults, $1\frac{1}{4}$ grains to $15\frac{1}{2}$ grains. Sziklai (Wiener med. Woch., Nos. 32, 33, '94).

In bronchitis with asthma, in winter-cough, and in hiccough jaborandi has proved of great benefit.

Patient whom obstinate, continuous hiccough had brought very low, and for whom many therapeutic measures had been employed without relief. Prompt success, however, followed the administration of a decoction of jaborandi. Kütke (Med. and Surg. Reporter, Apr. 21, '88).

CUTANEOUS DISORDERS.—In skin diseases characterized by a deficient secretion of the sweat-glands and in those of rheumatic origin, jaborandi has proved efficient. In chronic eczema Koltz has obtained favorable results from hypodermic injections of 10 to 15 drops of a 1-per-cent. solution of pilocarpine. Poulet suggests that the same procedure may be of service in the treatment of elephantiasis arabum. Jaborandi has alleviated urticaria, and doses of $\frac{1}{20}$ grain have proved remedial in hyperidrosis and bromidrosis.

Pruritus is not uncommonly relieved by this agent. The itching of jaundice is amenable to pilocarpine if the drug is well borne and diaphoresis ensues.

R. M. Simon, of Birmingham, finds nothing so useful as pilocarpine hypodermically in the treatment of pruritus senilis. It relieves the itching and allows the patient to sleep. In alopecia the use of jaborandi internally—or, better, applied locally—encourages the growth of the hair. If too much is used, small pustules may develop about the hair-follicles. Bartholow suggests the following in cases of alopecia:—

℞ Fluid extract of jaborandi, 1 ounce.
Tincture of cantharides, $\frac{1}{2}$ ounce.
Soap-liniment, $1\frac{1}{2}$ ounces.

Mix and apply night and morning with friction. For the same purpose Hare suggests the use of:—

℞ Fluid extract of jaborandi, 1 drachm.
Tincture of capsicum, 1 ounce.
Tincture of cantharides, $\frac{1}{2}$ drachm.
Castor-oil, 1 drachm.
Alcohol, enough to make 4 ounces.

DEFICIENT GLANDULAR SECRETION.—Dryness of the tongue and aptyalism may be relieved by small doses ($\frac{1}{200}$ to $\frac{1}{100}$ grain) of pilocarpine. The dryness of the mouth often so troublesome in diabetes mellitus is relieved in the same manner.

In the agalactia of nursing women, small doses of pilocarpine restore the secretion of milk.

OPHTHALMIC DISORDERS.—Pilocarpine is useful in all disorders of the eye associated with increased ocular pressure. De Schweinitz recommends very highly the hypodermic use of pilocarpine ($\frac{1}{12}$ to $\frac{1}{10}$ grain daily) for opacities of the vitreous humor. Diaphoresis should be

avoided. As a myotic (1 to 4 grains to the ounce) it is rapidly taking the place of eserine; 1 or 2 drops every hour may be used until the patient is relieved. Pilocarpine is useful as a tonic to the eye; to relieve eye-pain after excessive use of the eyes use $\frac{1}{10}$ grain of pilocarpine and 4 grains of boric acid to the ounce of distilled water, a few drops of the solution being dropped into the eye three times daily (Hare). Clinical reports show that pilocarpine in small doses is a very good remedy in tobacco-amblyopia and alcoholic amblyopia. Burnham, of Toronto, reports the good effects of the remedy in a case where the centre of each cornea was studded with infiltrations; the pupillary area was involved and vision was imperfect. A few drops of a 2-grain solution of pilocarpine may be employed locally with advantage in rheumatic iritis. Staderini advises pilocarpine nitrate ($\frac{1}{8}$ to $\frac{1}{10}$ grain) hypodermically, in many inflammatory diseases of the eyes, especially in those consequent upon rheumatism, as episcleritis, iritis, and idiopathic optic neuritis.

Good results from injections of small amounts (2 to 3 centigrammes) of concentrated solutions of pilocarpine in cases of blood in the anterior chamber, and in vitreous opacities after iridocyclitis and choroiditis without general disease. Bock (Centralb. f. die gesammte Ther., Mar., '88).

In the treatment of conditions of the eye and ear in which jaborandi is thought to be useful, it is probably better to administer the alkaloid pilocarpine hypodermically rather than to employ the infusion. Laval (Ther. Gaz., Sept. 15, '97).

Gratifying results obtained with pilocarpine in the treatment of interstitial keratitis, traumatic purulent iritis, vitreous opacities, and retinochoroiditis. Some nerve-specialists place great reliance upon the drug in toxic insanity after influenza, autointoxication, and similar processes, the brain rapidly

clearing after two or three sweats. Apart from its action hypodermically, pilocarpine or the fluid extract of jaborandi in small doses by the mouth has been found to be of value, especially in degeneration of the vitreous. The persistent nausea so common after the use of the drug is usually relieved by small doses of chlorodyne, as suggested by Dr. H. C. Wood. H. F. Hansell (Phila. Med. Jour., May 4, 1901).

AURAL VERTIGO.—In cases of obstinate aural vertigo a most efficient treatment is the use of pilocarpine every few days in sufficient doses to produce some salivation, the patient lying down or going to bed after each dose.

Three cases of Ménière's disease in which the hypodermic use of pilocarpine gave satisfactory results. The medication was given in daily doses of from $\frac{1}{25}$ to $\frac{1}{4}$ grain. These injections were generally followed by sialorrhœa and profuse diaphoresis. Labit (Revue de Laryn., d'Otol., et de Rhin., Sept. 1, '94).

ANTIDOTE TO ATROPINE.—Although atropine is a very efficient antidote against poisoning by pilocarpine, pilocarpine is less potent as an antidote in poisoning from atropine. However, McGowan relates a case in which two injections of $\frac{1}{2}$ grain each were undoubtedly the means of saving the life of a patient suffering from belladonna poisoning. The same procedure is recommended as beneficial in acute alcoholism.

Patient quickly brought out of a condition of alcoholic coma by the administration of pilocarpine and a hot-air bath. G. W. Davis (Kansas City Med. Index, Nov., '88).

C. SUMNER WITHERSTONE,
Philadelphia.

JACKSONIAN EPILEPSY. See EPILEPSY.

JAIL-FEVER. See TYPHUS FEVER.

JALAP.—Jalap (Jalapa, U. S. P.), named from Jalapa, a city of Mexico, is

the dried tuberous root of the *Ipomœa Jalapa* (*Exogonium purga* or *Ipomœa purga*), one of the *Convolvulaceæ*, which is indigenous to Mexico. The root has a peculiar smoky odor, and an acrid, sweetish, and nauseous taste. As seen in the shops, it is usually in a yellowish-gray powder. The active principle of jalap is found in a double resin in amounts varying from 12 to 18 per cent., which is divisible into two portions: one (convulvin) of which is hard and insoluble in ether, but soluble in alcohol and chloroform and partly soluble in water; the other (jalapin) is soft and soluble in ether and alcohol. Both are active purges, but convulvin is more potent (dose, 1 to 3 grains) than jalapin (dose, 2 to 5 grains). Jalap also contains about 18 per cent. each of starch and sugar. According to Poleck, jalapin is a resinous glucoside, separable by the action of hydrochloric acid into sugar and jalapinic acid, and identical with scammonin.

Preparations and Doses.—Jalapa, 10 to 30 grains.

Extractum jalapæ, 2 to 5 grains.

Pulvis jalapæ compositus (jalap, 35; cream of tartar, 65 parts), 10 to 60 grains.

Resina jalapæ, 2 to 5 grains.

Physiological Action.—Beyond the fact that jalap acts as a powerful hydragogic cathartic, and that gastro-intestinal irritation is produced by an overdose, little is known concerning the effects of this drug. It is also irritating when applied to the mucous membrane. According to Vulpian and Moreau, when applied to the exposed colon it gives rise to active peristaltic motion. Jalap passes into the milk of wet-nurses and purges their nurslings.

Poisoning by Jalap.—Jalap when taken in overdose acts as a simple irri-

tant poison to the alimentary canal, the symptoms being copious watery stools, tormina, and tenesmus. The treatment of poisoning consists in the evacuation of the retained jalap by the stomach-pump and the use of demulcent drinks.

Therapeutics.—Jalap is used principally as an hydragogic purge to relieve dropsical effusions, anasarca, and ascites. The resin, being the active constituent (containing both convulvin and jalapin), should generally be preferred. As it is almost tasteless and the dose small, it may be readily given to children in doses of $\frac{1}{4}$ to $\frac{1}{2}$ grain. Jalap is contra-indicated in inflammatory states of the intestinal canal. Combined with calomel, it is probably the best purge in cases where the liver is torpid. The compound jalap powder is most often used as an hydragogic cathartic for dropsy, either of cardiac or renal origin. In pulmonary congestion and distended right heart with cyanosis, dyspnœa, and so-called cardiac asthma, a teaspoonful of compound jalap powder will give relief. In hæmorrhoids it does not cause irritation, but relieves them by emptying the vessels above, and clearing out the liver.

JAMBUL.—Jambul is a tree that grows in most tropical climates, and belongs to the *Myrtaceæ*. It is the *Eugenia jambolana* of Lamk or the *Syzygium jambolana* of de Candolle. From the fruits, by alcoholic fermentation, a liquor is obtained, the *jambava* of the Hindoos. This liquor, allowed to acidify, turns into a vinegar, of an agreeable taste, and is extensively used by them as a stomachic, carminative, and diuretic.

Three varieties of jambul grow in India, and the ripe fruit can be eaten in season; at other times the fruit preserved in spirit can be employed. The powdered seed in doses of about 5 to 10

grains three times a day is recommended as a very effective means of administration. A vinegar of a light-pink color can be prepared by exposing the juice of the ripe fruit, contained in porcelain vessels, to the heat of the sun; after the juice has commenced to ferment it is filtered and again set in a warm place for a fortnight, when it is ready for use. The best form is either the whole fruit preserved in alcohol, the powdered seed, or a fluid extract of the seeds. The pulp of the dried fruit is believed to be almost worthless.

To obtain the seed fit for use it is necessary that the tree from which it is gathered should be of the right variety of jambul, and that no "wind-falls" or rotten fruit be included. The native physicians believe that this remedy is of the greatest use in the treatment of diabetes, and that there is no necessity to restrict the patient's diet, as this prevents the possibility of the excretion of sugar in the urine. Rudolf (Bull. Pharm., No. 1, '98).

Preparations and Dose.—The preparation generally employed is the powder, which may be given in doses varying from 8 grains to 1 drachm.

A fluid extract is more conveniently administered, and can be given in graded doses from 10 to 30 minims, according to the results obtained, in emulsion or capsules.

Physiological Action.—The manner in which the reduction of sugar in diabetic urine occurs when this agent is administered is not known, no untoward results having been noted in any case that could give a clue to its action. It acts as a gastric tonic through a principle that resides in the seeds, the bark, and the fruit of the plant.

Its properties, however, are principally in the seeds, which, according to the latest analyses, especially that of Elborne, contain essential oil, chlorophyl, resin, gallic acid, albumin, coloring extracts, and an insoluble residue. These grains

appear to contain an active principle, a glucoside, to which the physiological effects of the plant are due, but which, as yet, has not been isolated.

Von Mehring has shown that phloridzin, a glucoside extracted from the apple-tree, the pear-tree, and other plants, has the power of producing sugar in the urine of animals. Groeser instituted a series of experiments upon animals, and administered phloridzin to dogs in the proportion of 15 grains per 2 1/2 pounds of body-weight, and was able to produce a considerable amount of glycosuria, which persisted from twenty-four to thirty-nine hours. It was also found that phloridzin caused diarrhœa. Assured of the effects of this glucoside, the experimenter then submitted the dogs to the conjoined action of phloridzin and the extract of jambul, and found that under such circumstances the sugar of the urine was invariably diminished almost to one-half of that secreted under the action of the phloridzin alone, and also that the duration of the glycosuria was considerably lessened. In pushing his experiments in order to determine the toxicity of jambul, Groeser noticed that as many as 5 drachms of the drug could be given in a day without producing in the dog any deleterious effects, with the exception of some diarrhœa. (Egasse.)

Therapeutics.—The juice of the fresh bark, mixed with goats' milk, is said to be used in the treatment of infantile diarrhœa. It has also been used as an astringent in the form of gargles and lotions.

DIABETES.—The plant has been especially extolled in the treatment of diabetes. The natives of India and the English physicians were the first to speak in favor of jambul as a remedy for diabetes mellitus. The experiments of Lascelles Scott, T. A. E. Balfour, and G. Sims

Woodhead show that jambul has the power to stop, in a marked degree, the conversion of starch into sugar, and that this action increases proportionately to the quantity of the drug used.

Following the results of the experiments of von Mering, clinicians have employed jambul, with varying success, in the treatment of diabetes in man. Egasse has shown that the drug can apparently do good only in the mild forms of diabetes, but in which kind of diabetes it will do the most good has not yet been determined. The facts so far collected point to the insipidus form. The drug has been employed mostly in the form of powder. The minimum dose may be set down as from 4 to 7 grains, repeated three or four times a day, but it can be increased to even $1\frac{1}{2}$ drachms in the twenty-four hours, according to the requirements of the individual cases.

Case of a man, 65 years of age, who, in spite of a diabetic *régime*, continued to present all the symptoms of a well-developed glycosuria. Before the drug was administered the patient weighed 175 pounds, and every twenty-four hours he would pass $5\frac{1}{2}$ pints of urine of a specific gravity of 1038, of a yellowish-green color, of an acid reaction, and containing 4 ounces of sugar. After a month's treatment the specific gravity of the urine was 1038; this was reduced to $3\frac{1}{2}$ pints every twenty-four hours, and the quantity of the urine lowered to $2\frac{1}{4}$ ounces. In seven more days the sugar was increased to 3 ounces, and the results in general were little satisfactory. In three more weeks the patient had lost 1 pound in weight, and both the quantity of the fluid and the amount of sugar continued to increase. The patient was again subjected to a diabetic diet and the powder of jambul in appropriate doses, but the ultimate results continued to be negative. The author, however, attributes the failure to the advanced age of the patient, which, in itself, made the case a rebellious one. A. E. Balfour

(New Commercial Plants and Drugs, No. 11, '89).

Three cases of marked glycosuria treated with jambul. In two cases the drug was employed in the form of powder, in doses of 15 grains three or four times a day, during twelve consecutive days. In the third instance the same amount was administered in the same manner for one hundred and forty-seven days, but no good results followed. Javeine (Wratsch, No. 47, '89).

Two cases of diabetes in which jambul was employed. Success was observed in the first case. In the second instance the drug proved wholly inefficacious. J. A. Granger and H. Vandenberg (Nederlandsch Tyd. voor Genees., vol. ii, No. 1, '90).

Extract of jambul used in the treatment of glycosuria, the rind being used instead of the fruit in the preparation. This makes it more agreeable in taste and much cheaper than the fruit. As much as $1\frac{1}{2}$ ounces per day can be administered for a long period without disagreeable effects. It is best given in water or wine. Vix (Therap. Monats., Apr., '93).

JAUNDICE (ICTERUS).

Definition.—This is not a disease, but only a symptom-group, occurring under a variety of conditions and characterized by a yellowish discoloration of the skin, tissues, and fluids of the body with bile-pigment, and the excretion of the pigment in the urine.

It has been customary to classify all cases of jaundice into the two great groups of obstructive and non-obstructive jaundice, but, the more thoroughly the pathology of the condition is investigated, the greater is the number of non-obstructive cases that are found in reality to be obstructive, and in time it is probable that in all conditions jaundice will prove to be obstructive in origin.

William Hunter, in "Allbutt's System of Medicine," designates the two groups of jaundice as obstructive and toxæmic;

these seem to be the most suitable terms at present available. The obstructive group includes all cases dependent on palpable obstruction; and the toxæmic those occurring in connection with some general infection.

Jaundice resulting from mental emotion, usually of a depressing nature, cannot be placed in either group; its nature is quite uncertain.

Case of jaundice due to emotion. It occurred in a woman of 24 years, apparently not neurotic, and manifested itself five or six hours after the nervous shock. Talamon (*La Méd. Mod.*, Aug. 23, '93).

Case of jaundice developed after an instrumental delivery in a highly-sensitive young woman. E. A. Lubbock (*Brit. Med. Jour.*, Apr. 21, '94).

Three cases noted in which jaundice supervened in children of nervous diathesis after emotional excitement. Coulon (*Brit. Med. Jour.*, May 19, '94).

Jaundice from suppression of liver-function cannot now be accepted as possible, as bile-pigment can only occur as the result of hepatic cell-activity. Further, the removal of the liver or the complete severance of its connections by ligature does not cause jaundice.

Jaundice is due to increased function of normal liver-cells, by different stimuli. A normal liver-cell which can take up and elaborate an excess of nutriment, and thus produce an increased quantity of bile, can eliminate this excess into the intercellular bile-passages. A part of the bile passes into the blood; in part, directly through the walls of the blood-capillaries. The bile reaches the general circulation through the blood-capillaries of the hepatic veins and only to a slight extent through the lymphatics of the larger bile-channels. Browiez (*Wiener klin. Woch.*, Aug. 30, 1900).

Blood-serum is found stained in icterus, even in the mildest grades and though the urine at the time show absolutely nothing. The early diagnosis of icterus often cannot be made by an examination of the urine. A simple and

accurate method for making the diagnosis is to puncture the ear or finger and to fill several capillary tubes, one and a half millimetres in diameter and ten millimetres long, with blood; then to close the tubes at each end with sealing wax, place them vertically, and observe them after a few hours, when the serum and blood will have become separated. A yellow tinge to the serum is an early and important indication of jaundice. Hamel (*Deutsche med. Wochen.*, Sept. 25, 1902).

In the typical cirrhoses of Laennec, certain of the bile capillaries or so-called precapillaries are much constricted or even completely closed by the new connective tissue growth in the portal spaces of the liver. As a result there ensues a dilatation of the bile capillaries, with ultimate rupture and escape of bile into the perivascular lymphatic spaces. Eppinger (*Beiträge zur Path. Anat. u. z. All. Path.*, vol. xxxiii, p. 123, 1903).

I. Obstructive Jaundice (Hepatogenous Jaundice; Extrahepatic Jaundice).

General Symptoms.—The color of the skin varies according to the intensity and duration of the jaundice. In cases of catarrhal jaundice with sudden obstruction the surface becomes rapidly stained a deep yellow. When jaundice has existed for a considerable time it changes to a greenish hue, which gradually passes into a dark-olive color, doubtless on account of the action of the air on the bile-pigment in the skin. This very dark color known as "black jaundice," though not pathognomonic of cancer in the liver, is rarely produced by any other disease. The icteric hue shows most distinctly on the pallid parts and to a much less degree on highly-colored parts, as the lips, florid cheeks, mucous membrane of the mouth, etc. We, therefore, look to the conjunctivæ for the first signs of icteric discoloration.

Series of experiments on dogs leading to the following conclusions: 1. Contrary

to accepted pathological doctrine, the bile which is eliminated by the urine and deposited in the skin, in cases of obstructive jaundice, does not find its way into the general circulation through being absorbed by the blood-capillaries.

2. It is the lymphatic system of vessels alone which absorbs the biliary matters in obstructive jaundice, and it is through the instrumentality of the thoracic duct that they reach the general circulation.

3. After the thoracic duct has been ligatured for some days, supplementary ducts form by the coalescence of either entirely new or pre-existing, small, collateral lymphatics from the thoracic duct, at a point below the seat of ligature, through which its lymph-stream passes vicariously into the right innominate vein. 4. After the common bile-duct is ligatured, the whole of the constituents of the pent-up bile do not become equally concentrated, the less soluble, such as cholesterolin and mucin, being by far the most concentrated. 5. From the dogs experimented on having, in many cases, not only lived, but even gained in weight, after bile was prevented from finding its way into the duodenum, it may be inferred that the admission of bile into the digestive canal is not absolutely essential to life. 6. Ligaturing the thoracic duct not only prevents the occurrence of obstructive jaundice, after the occlusion of the common bile-duct in dogs, but checks it even after it has set in. Vaughan Harley (*Brit. Med. Jour.*, Aug. 20, '92).

By the aid of injected and safranin-stained microscopical liver preparations the following facts demonstrated: 1. The secretion-vacuoles of the liver discovered by Kopffer do not form the terminals of the bile-channels, but the liver-cells are filled with a fine canal-reticulum surrounding the nucleus; this reticulum is continuous with the intercellular bile-capillaries. 2. An injection of the liver-cells is possible by way of the blood-vessels, since a dense net-work of blood-capillaries surrounds the nuclei of the liver-cells. From these results the new theory submitted in reference to congestion-jaundice: In entering the blood-channels it is not necessary that the bile should go by the route of the thoracic duct; admission to the blood may occur

in the liver-cells themselves by diffusion from the bile-capillaries surrounding the nuclei into the neighboring blood-capillaries. C. Nauwerck (*Münch. med. Woch.*, xliv, 2).

Many of the secretions are also colored with bile-pigment. The sweat is yellow and stains the patient's linen. The tears and milk may also be colored, but the saliva is not stained nor do the secretions of the mucous membranes, not even of the bile-ducts and gall-bladder, contain any bile.

Inflammatory exudates, as the sputa of pneumonia, are bile-stained, as are also the exudates into the various serous cavities.

Since the removal of diffusible substances in the blood is chiefly by the kidneys, it follows that the urine contains more of the biliary coloring matter than any other secretion. It may be present in the urine before it appears in the conjunctiva even. The color of the urine may vary from a barely perceptible greenish-yellow to a dark-brown or even black color. Bile-pigment is invariably present in the urine in jaundice, except in chronic cases in which the obstruction to the bile-flow is suddenly removed, when the icteric hue of the skin will persist after the blood has been cleared of the bile-pigment. Bile-stained urine foams readily when shaken, and the froth is of a yellow color. Rhubarb and santonin, when administered, produce a similar color in the urine, but the froth is not yellow; the addition of caustic potash causes a red coloring of the fluid and the tests for bile-pigments are not obtained.

Gmelin's test is usually employed to determine the presence of bile-pigment, but it may fail to give a reaction even in the presence of 5 per cent. of bile. It is best made by placing a few drops of common nitric acid and of the urine on a

white, flat surface and then causing them to run together. A play of colors results at the margin of contact, rapidly passing through various shades of green, blue, violet, and red, finally becoming a dirty yellow.

The following modification of it is much more delicate, revealing even 0.2 per cent. of bile, and should be employed in doubtful cases: "To 50 cubic centimetres of urine add 5 cubic centimetres of 10-per-cent. barium-chloride solution and 5 cubic centimetres of chloroform. Shake for several minutes. Set aside for ten minutes. The chloroform and precipitate of phosphates fall down, carrying with them all the bile-pigment. Now draw off the chloroform and the precipitate with a pipette. Place in a flat dish, and set over a basin of hot water until all the chloroform has evaporated. Allow to cool and pour off any fluid from the precipitate. The latter will be yellowish. Place impure nitric acid in drops here and there on the surface of the precipitate. If bile-pigment is present a play of colors appears round each drop." ("Clinical Methods," by Hutchinson and Rainy.)

The stained cellular elements in the urine afford a reliable test for the presence of bile-pigment. In chronic cases the urine may contain albumin and pigmented tube-casts.

In those slight forms of jaundice in which bile-pigments do not appear in the urine in appreciable quantity the spectroscope furnishes a very delicate and accurate test. Parmentier (*Gaz. des Hôp.*, p. 136, '88).

In ordinary jaundice the color of both skin and urine is due to bilirubin. Leube (*Centralb. f. klin. Med.*, Nov. 30, '90).

The following recommended as a simple method of detecting bile-pigment in icteric fluids: To about 1 1/4 fluidrachms of serous fluid add twice or thrice its volume of concentrated alcohol, and shake the mixture. Add as many drops

of hydrochloric acid (10 to 25 per cent.) as will be required to dissolve the precipitation caused by the addition of the concentrated spirits, when the fluid will become clear. Bring the fluid to a boil, and if gall-pigment be present a blue-green color will appear within a minute or so. In a serous exudation containing only 1 part of bilirubin to 250,000 parts of fluid, the blue-green color became very conspicuous. When it is desired to ascertain the presence of an insignificant quantity of the coloring matter of the bile in concentrated fluids rich in albumin, the author proceeds as follows: To 3/4 or 1 fluidrachm of the fluid add four or five times its volume of concentrated spirit, which will cause the precipitation of all the proteid substances present. Shake well several times and filter the fluid. Add several drops of hydrochloric acid and boil, when, if gall-pigment be present, a delicate blue-green color will appear. Israel Hedenius (*Läkäref. förh.* vol. xxix, Nos. 7, 8, '95).

Jaundice may be distinguished from the yellow hue caused by malaria, cancer, lead poisoning, and some kidney affections by placing a few drops of the urine in a porcelain dish and causing a couple of drops of nitric acid to flow against it. If bile-pigment be present, a greenish tint will result, followed by blue, violet, and a yellow or brown. John Inglis (*Columbus Med. Jour.*; *Monthly Retrospect*, Apr. 15, '98).

As no bile enters the intestine, the fæces are pale or clay-colored, on account of the large amount of fat present. They are pasty and usually foetid. There is usually constipation, but diarrhoea is not infrequent, owing to the decomposition in the intestines. There may be no derangement of the stomach, but often there is loss of appetite, coated tongue, foul taste, foetid breath, and epigastric fullness after food.

The clay color of the stools is due to the undigested fat, and in jaundiced patients who are fed on free fat food this peculiar odor is not present. Strumpell (*Lehrbuch d. spec. Path. und Ther. d. inneren Krank.*, B. 1, '88).

In the absence of bile from the intestine, in jaundice, there is an increase in undigested fat from 6.9 and 10.5 per cent., the normal amount, to 55.2 and 78.5 per cent. Müller (*Zeit. f. klin. Med.*, B. 12, H. 1, 2, '88).

Attention called to the difference between icterus from obstruction and true polycholic icterus, in which there is hypersecretion of bile. In the former the stools are alcoholic, while in the latter they retain their normal color. Polycholic icterus, rare in temperate climates, but very frequent in hot countries, is associated with an acute congestion of the liver, and is accompanied by fever. It does not last long unless it occurs in relapses. Icterus, not polycholic, yet without discolorization of the stools, may also occur when there is incomplete compression of the small bile-ducts. Jaccoud (*Jour. de Méd. et de Chir. Prat.*, June, '90).

Case of a girl of 16 years, who became jaundiced when six years old, and remained so six months. At thirteen there was another attack of jaundice lasting eight months, and at fifteen one of six months' duration. The fourth attack came on at sixteen, and when reported had lasted four months. According to the mother, an inflammation of the throat preceded every attack. In the previous attacks, especially the second, there was severe pain in the region of the stomach and liver, not colicky. Chills and fever have not been present. Recovery from the attacks begins suddenly. In the present attack there is no fever, the appetite is good, and bowels regular; the patient is emaciated and feels weak. The jaundice is intense; there is great itching. Ascites and enlarged spleen are absent. The liver is enlarged all over, dullness extending from the upper border of the fifth rib in the mammillary line to three fingers' breadths below the rib. The surface is hard, uneven, and sensitive. The fæces for months have been without bile-coloring matter. The case is probably one of gall-stone with secondary hypertrophic cirrhosis of the liver. Albu (*Deutsche med. Woch.*, No. 13, '98).

Slow pulse is very characteristic; it is usually from 40 to 60, but may be down

to even 20 per minute. Such pulse-changes are more frequent in catarrhal jaundice and are not usually of unfavorable significance. The respirations are usually normal, but may fall to 10 or less per minute.

In many protracted cases there is a marked tendency to hæmorrhages, especially to purpura and to subcutaneous extravasations. The blood requires in some of these cases eleven or twelve minutes to coagulate instead of three or four, as in normal states (Osler).

Surgical operations should only be undertaken in case of chronic obstructive jaundice with due regard to this change in the blood.

Icteric blood is deficient in sodium chloride. This depends on a lack of NaCl and a reduction in the volume of the serum. The latter is produced by an increase in the volume of the red corpuscles, which, in turn, is due to the presence of bile-salts in the plasma. V. Limbeck (*Centralb. f. innere Med.*, No. 33, '96).

In chronic jaundice there is a marked tendency to hæmorrhage and in operating upon such cases surgeons have to count this as a possible serious accident. Within the past few years, the writer has known of three fatal cases of hæmorrhage following operations under these conditions. A recent case suggests the possibility of the value of taking the blood-coagulation time. The case was one of jaundice with pains suggesting gall-stones, and Dr. Finney operated. The patient almost bled to death on the table. The wound was packed with gauze, and the patient was taken back to the ward in a very exhausted condition. He bled very actively every time an attempt was made to remove the gauze, and it was at least three weeks before all of it was taken out of the wound. His blood-coagulation time, as taken with Wright's tubes, was between ten and eleven minutes, more than double the normal. It certainly would be advantageous to test this point in cases of chronic jaundice before operation, and it might be worth while also to follow out

Professor Wright's suggestion, and to give the calcium chloride in full doses for a period of ten days in order to increase, if possible, the coagulability of the blood. William Osler (Montreal Med. Jour., Jan., '98).

The persistent and uncontrollable capillary hæmorrhage so often occurring in operations on deeply jaundiced subjects is especially apt to follow when the cause of the jaundice lies in malignant obstruction of the bile ducts. During the past year, two of the author's patient's have succumbed from bleeding, in spite of a systematic administration of calcium chloride in both small and large doses, given at least five days before the operation. Berg (Annals of Surg., Sept., 1903).

Pruritus is often a distressing symptom in the chronic forms of obstructive jaundice. It occasionally precedes the onset of the jaundice. It is worse at night and may be general or localized. Scratching gives rise to various eruptions. Sweating is frequent. Urticaria, lichen, and boils may be present, as may also xanthelasma.

Cutaneous pruritus, so common in jaundice from retention, may appear and persist for a long time before the icterus is evident. This precocious pruritus is observed especially in cases in which the obstruction to the flow of the bile is caused by a neoplasm situated somewhere along the course of the biliary passages. Bouchard (Med. Rec., Apr. 14, '94).

The thyroid gland or extract exerts a favorable action on the pruritus which so often accompanies jaundice, this symptom becoming much less troublesome, or ceasing altogether while the thyroid was being taken. At the same time the bile-salts, tested for by Hay's sulphur reaction, gradually disappeared from the urine; this also occurred in cases free from pruritus. There was no alteration in the pigments of the urine, as shown by Gmelin's test. Gilbert and Herrscher (Comptes-Rendus d. Soc. de Biol., Aug., 1902).

Cerebral symptoms may be marked, in-

cluding irritability, great despondency, and even melancholia. There are often headache, vertigo, and dullness; there may be sleeplessness. Specially severe symptoms may develop in persistent jaundice and quickly prove fatal. Usually there is slight fever, rapid pulse, emaciation, and mild delirium. From this typhoid state the patient may soon become comatose or develop convulsions. This condition was formerly denominated *cholæmia*, or sometimes *cholesteræmia*. Its cause is uncertain, but probably most cases are due to a "terminal infection."

Etiology.—This class includes the cases that "result from obvious mechanical obstruction" and are "independent of changes in the blood or bile" (Hunter).

Murchison classified this group as follows:—

1. Obstruction by foreign bodies within the duct, as gall-stones, inspissated bile, parasites, etc.

Catarrhal jaundice is not merely a mechanical plugging of the bile-ducts with mucus, or a closure of the ducts with inflammatory swelling, but is really toxic in character, ordinary catarrhal jaundice being due to toxic substances developed in the alimentary canal. Obstructive jaundice is due to gall-stones, tumors, hepatic abscesses, and cirrhosis. If jaundice is associated with gall-stones, it is generally due to inflammation rather than to obstruction. Renvers (Modern Med. and Bact. Review, Apr., '97).

2. Obstruction by inflammatory tumefaction of the duodenum, or of the lining membrane of the duct and exudation into its interior.

Catarrhal or simple jaundice results from the following causes: 1. Duodenal catarrh, in whatever way produced, most commonly following an attack of indigestion. It is most frequently met with in young persons, but may occur at any age, and may follow not only errors in diet, but also cold, exposure, and malaria,

as well as the conditions associated with portal obstruction, chronic heart disease, and Bright's disease. 2. Emotional disturbances may be followed by jaundice, which is believed to be due to catarrhal swelling. Cases of this kind are rare and the anatomical condition is unknown. 3. Simple or catarrhal jaundice may occur in epidemic form. 4. Catarrhal jaundice is occasionally seen in the infectious fevers, such as pneumonia and typhoid fever. William Osler ("Principles and Pract. of Med.," p. 430).

3. Obstruction by stricture or obliteration of the duct, as may result from perihepatitis, or from a cicatrix in the duct or at its mouth in the duodenum.

The occurrence of jaundice is, as a rule, only possible when there is an obstruction of the common bile-duct. There are one or two exceptions, viz.: a rare form of blood-dyscrasia and yellow fever. Biliousness is the result of functional derangement of the liver, while jaundice is the result of obstruction of the common duct. Jacob Michaux (Gaillard's Med. Jour., vol. lxxvii, No. 1).

Case of fatal infantile jaundice from congenital narrowing of the bile-duct. J. A. C. Kynoch (Edinburgh Med. Jour., July, '96).

4. Obstruction by tumors closing the orifice of the duct or growing into its interior.

Causes of icterus gravis: 1. Mechanical occlusion of the lumen of the cystic and common ducts by calculi, hepatic growths, enlarged head of the pancreas, carcinoma of the duodenum, tumors of the transverse colon, etc. 2. Acute yellow atrophy. 3. Terminal stage of atrophic cirrhosis. Mester (Deutsche med. Woch., Nov. 27, '90).

Four cases in which death followed symptoms of obstructive jaundice due to cancer of the ductus choledochus communis with signs of excessive amount of colloid material in the thyroid gland. In those cases, the antitoxic function of the liver having been notably impaired, the thyroid was excited to vicarious action by the toxic substances circulating in the blood. Lindemann (Archiv für pathol.

Anat., etc.; Gaz. Hebdom. de Méd. et de Chir., Nov. 28, '97).

Examination of the liver from a woman, aged 53, who had died after symptoms of obstructive jaundice. There was a large caseating gland surrounded by a dense mass of fibrous tissue involving the hepatic duct. There was also some perihepatitis with several small abscesses throughout the liver. Whyte (Brit. Med. Jour., Jan. 1, '98).

5. Obstruction by pressure on the duct from without by (a) enlarged glands, (b) hepatic tumor, (c) tumor of the pylorus, (d) tumor of the pancreas, (e) tumor of the kidney, (f) omental tumor, (g) an abdominal aneurism, (h) faecal accumulation in the colon, (i) ovarian or uterine tumors.

Conclusions based on a study of jaundice and its treatment: 1. Long-continued biliary stasis, compromising the secreting cells of the parenchyma of the liver and producing a certain anæmia of the organ, markedly reduces and sometimes suppresses the secretion of the biliary acids. The gravity of the phenomena described under the name of biliary intoxication does not, therefore, depend upon the action of these acids. 2. The scarcity or absence of bile in the intestinal canal modifies very seriously the chemical processes there taking place. 3. One of the most common of the gastric changes in the icterus is the suppression of hydrochloric-acid secretion. 4. There is little or no loss of carbonate of sodium in these cases. 5. The reaction of the contents of the stomach is usually alkaline, less often neutral or faintly acid. 6. The physiological activity of the bile and of the pancreatic juice in the intestine is retarded. 7. The chlorides in the urine is increased; there is a diminution of urea, with an abundance of products of the aromatic series. 8. The more marked these characters, the graver the disease and its clinical manifestations. 9. Alkaline treatment does not modify these conditions. The effect of the acid treatment is, however, to diminish the chlorides, to restore the normal acidity of the urinary reaction, to increase the excretion of urea, and to re-

duce that of the aromatic products; and, at the same time, there is a progressive increase in the weight of the body. Alivia (*Med. Rec.*, Apr. 14, '94).

Analysis of 215 cases of simple catarrhal icterus in Senator's clinic. Nearly 42 per cent. occurred within the first decade; in the second decade the number dropped to 10 per cent. of the whole; in the third decade it rose again and went to nearly 27 per cent. It was therefore by far most frequent in the first decade, but it was notable that it practically never affected sucklings. As to the sex, females were somewhat more affected in the first five years of life, while in the third and fourth decade it affected men more commonly. These conditions are exactly similar to those that are observed in epidemic jaundice. Also in studying the time of the year at which the jaundice occurred the author noticed at once that the frequency always rose pronouncedly in the first and fourth quarters of the year; in other words, in the winter months; it then dropped. This is exactly the same condition as is observed also in epidemic jaundice. Likewise it is often seen that simple jaundice improves and then there is a relapse. This is much more readily explained by attributing the jaundice to the infection and the relapse to a reinfection than by attributing the whole matter to a simple catarrhal gastro-enteritis. The jaundice was distributed extremely irregularly throughout the city and showed no relation to the water-supply, but careful study showed that it sought out from year to year certain districts of the city, and this is believed to be further testimony that the cause is an infection and that the infectious agent remains active in certain regions when it once acquires a lodgment. Neumann (*Phila. Med. Jour.*, from *Deut. med. Woch.*, Aug. 31, '99).

Case of severe recurrent jaundice in which a hard tumor under the right costal margin led to an exploratory incision. The tumor was found to be a floating kidney, which pressed on the gall-bladder and bile-ducts. The kidney was returned to its normal position and fixed by sutures. The jaundice disap-

peared and the patient has been in perfect health since. P. C. Fenwick (*Lancet*, Nov. 11, '99).

Cases of three brothers and sisters between the ages of 17 and 26 years, who had suffered from jaundice since birth and whose mother had also been icteric since her birth. Other brothers and sisters were not affected. There was, in all the patients, a distinct yellowish tinge to the skin and connective tissues, but there were no biliary salts or pigment in the urine and the faeces were of normal color. The author attributes the jaundice to hepatic insufficiency, as urobilin was found in the urine of all the patients. Alois Pick (*Wiener klin. Wochen.*, Apr. 23, 1903).

Treatment.—The prognosis and treatment are further considered in dealing with the various diseases that give rise to obstructive jaundice. (See LIVER, DISEASES OF.)

The following substances have been found by experiment to increase the flow of bile: Group 1. Urea, oil of turpentine, and terpene. Chlorate of potassium increased the flow by once or twice the normal. Further, benzoate and salicylate of sodium, salol, euonymin, and muscarin used subcutaneously increase the secretion two or three times the normal amount. Group 2. Substances producing only a slight or doubtful and inconstant increase are: alkaline salts, Carlsbad salts, propylamin, antipyrine, aloes, cantharitic acid and rhubarb, hydrastis *Canadensis*, ipecac, and boldo. Thus, cathartics and the alkaline salts are not cholagogic in non-cathartic doses. Group 3. Substances diminishing the secretion: iodide of potassium, calomel, iron and copper, atropine, and strychnine. In regard to calomel, the writers have not been able to confirm Rutherford, who believed that what cholagogic action calomel had was due to the transformation into corrosive sublimate. The last-named substance given by itself produced no increase. Prevost and Binet (*Revue Méd. de la Suisse Rom.*, May to July, '88).

Massage recommended in the treatment of catarrhal jaundice. The method consists in rhythmical compression of the

hepatic region for ten minutes, thrice daily. Wechsler (Wratsch, No. 19, '93).

For itching in jaundice the following is recommended to be rubbed in several times a day:—

℞ Ichthyol, $1\frac{1}{4}$ to $2\frac{1}{2}$ drachms.

Alcohol,

Ether, of each, 2 fluidounces.

Boullard (Ges. Therapie, p. 380, '98).

Slight attacks of jaundice are of comparatively little surgical importance, and the majority of surgical diseases of the biliary passages have no jaundice at all. Persistent jaundice, especially if progressive, is usually a contra-indication to surgical measures; on the other hand, intermittent, deep jaundice, especially if associated with chills and a rise in temperature, denotes the presence in the common duct of a stone that urgently demands removal. Archibald Maclaren (Med. News, Nov. 17, 1900).

For the pruritus of jaundice sponging the body with sodium bicarbonate, 3 drachms in 1 pint of hot water, or McCall Anderson's dusting-powder of:—

℞ Camphor, $1\frac{1}{2}$ drachms;

Zinc sulph., $\frac{1}{2}$ ounce;

Starch, 1 ounce;

are useful. Gilman Thompson (Practical Medicine; Med. News, Dec. 1, 1900).

The following causes of chronic jaundice must be taken into consideration: (1) common-duct cholelithiasis; (2) chronic pancreatitis; (3) simple stricture of the common bile-duct; (4) inflammatory adhesions causing pressure on or stenosis of the hepatic or of the common bile-duct; (5) hydatid disease of the liver pressing on, or discharging into, the bile-ducts; (6) gummata implicating the ducts; (7) chronic catarrh of the bile-ducts; (8) cancer of the common bile-duct; (9) cancer of the head of the pancreas; (10) cancer of the liver associated with jaundice due either to catarrh or to pressure; (11) cirrhosis of the liver; (12) other rare causes, such as aneurism of the hepatic artery or of the aorta, and other tumors of the liver, gall-bladder, pylorus, or kidney, pressing on or occluding the common bile-duct.

Surgery holds out a good prospect of

cure in the first five causes enumerated; medical treatment alone is advisable for causes 6 and 7, and in the remainder with certain exceptions relief can be hoped for only from medical or surgical treatment. As in many other conditions, pain is the most valuable guide in establishing a differential diagnosis between those possible causes. A painless onset of chronic jaundice points to chronic catarrh due either to cancer of the liver or of the head of the pancreas, or both. On the other hand, pain in the upper abdomen, followed within twenty-four or thirty-six hours by jaundice, strongly suggests cholelithiasis. Here the jaundice is less intense and is pretty certain to be accompanied sooner or later by intermittent fever, chills, and sweats, with very marked icteric fluctuations. Ascites is very suggestive of malignant disease; it points to it perhaps more strongly than any other single symptom. Other diagnostic anti-operative aids are as follows: Jaundice in cancer of the bile-ducts and head of the pancreas tends to become absolute; in almost every other condition it is variable. Fat in the fæces and glycosuria, with very rapid wasting, are very suggestive of pancreatic trouble. If the anti-operative signs be difficult of true interpretation, those found after the abdomen is opened call for as much or more acumen. Adhesions in the neighborhood of a contracted gall-bladder suggest stones, but this may be induced by a simple pyloric ulcer. If the head of the pancreas be swollen and harder than normal, one should not too hastily pronounce it cancer; it may very probably be a simple chronic pancreatitis, curable by cholecystotomy. Again the discovery of enlarged glands does not warrant a gloomy prognosis, for discrete nodules are frequent in common-duct cholelithiasis and in chronic pancreatitis. If they are fused, however, the outlook is bad. The tumor composed of matted omentum and the viscera adjacent to an inflamed gall-bladder always presents a conundrum which aspiration even may not solve; it should not be pronounced malignant until the liver has been carefully inspected for nodules.

The treatment depends on the diagnosis. 1. If it be doubtful, an exploratory incision is indicated if the patient's general condition will permit. 2. If malignant disease be positively diagnosed, operation can, with some few exceptions, do but little good save when all the diseased tissue can be removed. 3. If gall-stones or any of the first five factors be diagnosed, operation is decidedly advisable if the patient be at all able to bear it. The two great dangers are hæmorrhage and shock—accidents such as are liable to follow any severe abdominal traumatism. A study of the unsuccessful cases will no doubt reduce the mortality even lower than it already is; within the last year it has dropped in cholecystotomy from 14.5 to 7.4 per cent. The anti-operative treatment of ordinary cases is in no way different from that given for a general laparotomy, but when a hæmorrhagic condition is expected calcium chloride is fed in heroic doses, as this has been found to aid materially in limiting capillary hæmorrhage by increasing the coagulability of the blood. A. W. Mayo Robson (Brit. Med. Jour., Jan. 18, 1902).

II. Toxæmic Jaundice (Hæmatogenous Jaundice; Hæmo-hepatogenous Jaundice; Jaundice of Polychromia; Non-obstructive Jaundice).

In this form there is said to be no obstruction in the bile-passages. Such in most, if not all, cases is not correct, because, although the larger ducts are free, the bile-radicles within and around the hepatic lobules are obstructed to a greater or less extent by swelled epithelium, pigment-granules, and crystals of leucin and tyrosin. The obstruction in these cases is shifted from the larger ducts to the biliary radicles, many of which escape, so that the obstruction is rarely complete. The cause acts on the liver-substance in general and must, therefore, be toxic and conveyed to it by the blood, either of the general or the portal circulation. The toxin acts on the blood, and in its excretion by the liver

leads to the secretion of a viscid bile, to irritation of the biliary radicles, and it may be to degenerative changes in the liver-cells.

There are cases of obstructive jaundice in which the occlusion occurs within the biliary lobules and is due to swelling of the epithelial cells. The swelling and degeneration of the hepatic cells are the result of the action of toxic substances introduced through the circulation. The treatment of this form of jaundice consists in the regulation of the diet, the improvement of the circulation and the blood, and remedies addressed to the liver to stimulate more active secretion, but, first of all, to reduce the cellular swelling so as to free the terminal biliary capillaries. Porter (Amer. Med.-Surg. Bull., Dec. 1, '94).

Hunter makes three groups of this class of cases:—

1. Jaundice due to poisons, as toluylendiamin, phosphorus, arseniuretted hydrogen, and snake-venom.

2. Jaundice occurring in various specific fevers, as yellow fever, malaria, pyæmia, enteric fever, typhus, and scarlatina.

3. Jaundice occurring in obscure infective conditions, as in epidemic, infectious, febrile, or malignant jaundice, icterus gravis, Weil's disease, and acute yellow atrophy of the liver.

In this class the jaundice is usually less intense than in obstructive jaundice. There is only a partial absorption of the bile-pigment by the lymphatics of the liver. Bile appears in the stools at some period of the history; it may be in excess, causing very dark fæcal discharges. There is usually more constitutional disturbance than in obstructive jaundice. In severe cases this is very pronounced—high fever, dry tongue, delirium, subsultus, convulsions, hæmorrhages from various parts, black vomit, all indicating severe constitutional infection.

All cases usually show (1) destructive

changes in the blood; (2) alterations in the quantity and quality of the bile; (3) changes in the liver-cells and bile-ducts, varying in degree according to the irritant power of the toxin.

The destructive changes in the blood are shown by the occurrence of hæmorrhages especially from the mucous surfaces, as of the nose and stomach. The black vomit of yellow fever furnishes a striking example of such hæmorrhages. The changes in the bile are characterized by its increased viscosity, great increase in its pigment, and lessening of the bile-acids. The parenchymatous changes in the liver are evidence of the action of the toxins on the liver. Similar changes occur in the kidneys.

In many varieties the toxins that excite these changes are generated in the intestinal tract, as gastro-intestinal symptoms are usually prominent in the initial stage of the illness. In this way we may account for the absence of specific organisms in the liver in acute yellow atrophy, for example.

The form of icterus gravis in which the bacillus coli is found is accompanied by lowering of the temperature, while the other forms of the same disease which are accompanied by fever are characterized by the presence in the liver and blood of pyogenic microbes. Undoubtedly, however, the micro-organisms play a rôle in the production of the lesions and symptoms of icterus gravis. Hanot (*Le Bull. Méd.*, Feb. 21, May 6, '94).

Case of primary icterus gravis observed in which the temperature always ranged below the normal. Death followed. Cultivations made with the blood and liver remained sterile and no micro-organism was demonstrated on staining the sections of that organ. J. Durante (*Bull. de la Soc. Anat.*, No. 24, '94).

Four cases of icterus gravis in which the results of bacteriological examination led the writer to conclude that they could be regarded as variable stages of the same form of septicæmia caused by

streptococci. Babès (*Revue des Sci. Méd. en France et à l'Etranger*, July 15, '94).

Three cases of icterus coming on at an early period of syphilis noted. Table of forty-six additional cases added with a view of establishing the differential diagnosis between simple catarrhal and syphilitic icterus. The latter usually comes on suddenly, without being preceded by the digestive disturbances which are the prelude of the catarrhal form; in some cases the digestion remains excellent throughout, though, as in catarrhal jaundice, there is a distaste for fats. Another point to be noted is the absence of any etiological factor except syphilis. The jaundice usually appears with the first eruption, and is most frequent in females. O. Lasch (*Berliner klin. Woch.*, Oct. 1, '94).

Observations based on 57 cases of jaundice occurring among 15,799 cases of early syphilis. Syphilitic jaundice is characterized by (1) its appearance in the early secondary stage, (2) the presence of fresh specific manifestations, (3) the influence of treatment, and (4) its sudden development without gastric disturbance. Long duration is not characteristic of syphilitic jaundice. In typical cases this icterus occurs at a time when syphilis affects the skin and mucous membranes. Hepatic enlargement is not a striking feature in the disease. In 22 out of 50 cases the jaundice was noted within six months after the infection. The syphilis in most of the cases was severe. In 50 cases cutaneous affections were present in 18, affections of the mucous membranes in 16. Marked glandular enlargement was present in 41 out of 50 cases. Werner (*Münch. med. Woch.*, July 6, '97).

Jaundice is a somewhat rare complication of pregnancy, Karl Braun having observed the grave form only once in 28,000 pregnant women, and Winckel only once in 16,000 cases. William B. Young (*Med. News*, Nov. 12, '98).

Icterus observed in four cases from the use of lactophenin. Kurt Witthauer (*Ther. Monats.*, H. 2, S. 111, '98).

Many varieties of jaundice are found in infancy. There is a benign icterus neonatorum, hæmatogenous in charac-

ter, or the jaundice may be septic. Related to this is that rare condition called Buhl's disease. Then there are Winckel's disease—afebrile, icteric cyanosis with hæmoglobinuria, easily recognized from its symptoms; infectious jaundice of the newborn, starting from the gastro-intestinal tract; plecchromic jaundice, following hæmorrhage; catarrhal jaundice; toxic jaundice; jaundice with acute atrophy of the liver; and congenital icterus, due to defect or obliteration of the bile-ducts, cirrhosis of the liver, and periphlebitis or growths in the hepatic or portal veins. B. Skormin (*Jahrbuch f. Kinderh.*, Aug., 1902).

Four cases in personal experience showing that jaundice is not an uncommon secondary manifestation. It yields, like other secondaries, to mercury, but appears, naturally, only in those subjects who have a predisposition to icterus. Simionescu (*Presse Med.*, Oct. 10, 1903).

Jaundice, severe or mild, is more likely to follow abdominal or quasi-abdominal operations than any other. While it is generally admitted that severe and fatal jaundice may be due to chloroform poisoning, it is not so well recognized that mild benignant types may also be due to the action of chloroform. Other causes may be found in emotion, fear of operation, or in the necessary manipulation of the peritoneum (which is not absolutely insensible) during operation. In the author's experience jaundice never followed operation without anæsthesia where the pain due to manipulation was manifestly felt by the patient. Santucci (*La Clin. Mod.*, An. x, No. 14, 1904).

In some cases, as in pyæmia and snake-venom, the poison finds its way to the liver through the general circulation.

Icterus Neonatorum.

Definition.—Icterus neonatorum is a mild transitory form of jaundice of uncertain causation appearing in infants soon after birth. There is also a severe form of jaundice caused by congenital absence or occlusion of the hepatic duct, or due to septic infections, especially

pylephlebitis. As this form does not arise from the same condition in the adult, it is wiser to confine the true "icterus neonatorum" to the first form.

Symptoms.—The icteric tinge is generally the only symptom, the child otherwise being well. It occurs in delicate children oftener than in the strong. It is seen more frequently in hospitals than in private practice, perhaps because the light is better in the hospitals and records are more carefully made. It is of frequent occurrence, being noted in as many as 80 or even 90 per cent. in some reports. It is probable that careful examination of all infants will reveal this large ratio. When very slight it may be best detected on the red skin rendered pallid by pressure. It usually appears on the second or third day, increases for a day or two and then disappears, the whole duration being from four to five days to a week, lasting a fortnight in severe cases only.

"It is first and most distinctly seen on the face—especially on the forehead and about the mouth—and in the chest; later it appears on the sclerotics, and last of all on the hands and feet" (Thomson).

In contrast with ordinary obstructive jaundice the sclerotics are discolored only slightly and late.

The urine is usually normal, not staining the napkin; but in severe cases bile-pigment is present in it.

In many cases icterus neonatorum is a symptom of some transient disorder, while in others it is of grave significance. From 30 to 80 per cent. of all infants have it. It usually appears within the first week, usually on the third or fourth day; first on the trunk and face, then on the limbs and conjunctivæ. In the milder cases the urine and fæces are normal. The child's health does not suffer, and after four or five days, or at least one or two weeks, the jaundice disappears. The text-books commonly give two weeks as the duration of severe cases, but cases

which lasted for two months and then passed off, leaving the infants apparently no worse than before the attack, have been personally observed. G. F. Still (*Clinical Jour.*, Mar. 13, 1901).

Diagnosis.—This in uncomplicated cases is easy. The colored stools, the pale urine, and the absence of grave symptoms serve to distinguish it even when severe from obstructive or septic jaundice, and from syphilitic disease of the liver, and obliteration of the bile-duct.

Two children of the same mother died of jaundice. The first pregnancy ran a normal course. The child was healthy during the first four weeks of life, but at that period icterus developed, and continued up to the time of the child's death, which occurred on the first week of the seventh month. The liver was enlarged during life. There was a small abdominal effusion. During the second pregnancy the mother was jaundiced two weeks prior to her confinement. The offspring became jaundiced in the third month. The jaundice fluctuated and at times quite disappeared. The child gradually failed and died. At the autopsy the liver resembled that of acute yellow atrophy. In the red stage the kidney showed an advanced fatty degeneration. The pulp of the spleen was much hypertrophied. Brandenburg (*Centralb. f. innere Med.*; *Inter. Med. Mag.*, Dec., '97).

Etiology.—It is of very uncertain causation; many theories have been advanced to explain it. Some have said that the condition is not a true jaundice, but pigmentation due to rapid destruction of red corpuscles in the first days after birth. The presence of bile-pigment and bile-acids in the pericardial fluids of icteric infants and not in others proves, however, the yellow discoloration to be due to bile, and bile is always the product of the liver-cell.

That the blood-destruction leads to a greater amount of pigment in, and inspissation of, the bile followed by partial stasis, and consequent absorption from

the biliary radicles, is probably the most reasonable theory. The causes may, however, be various, and several may be active in the same case.

Icterus neonatorum is ascribed by several authors to late section of the cord, whereby a greater mass of blood is thrown from the placenta into the child's circulation, and a great destruction of red corpuscles and coloring matter ensues, followed by icterus. To test this view, 50 children were at once separated from the cord at birth, and 100 later, mostly after separation of the placenta. Of the 50, 36 became icteric and 14 remained unaffected. Of the 100, 71 were observed; out of these, 30 were icteric and 41 remained well. The intensity of color and length of duration of the jaundice were more marked in those early separated than in others. Schmidt (*Archiv f. Gynäk.*, B. xlv, H. 2, '93).

The red corpuscles bear no etiological relation to icterus neonatorum. The number of erythrocytes during the first week of life is independent of the occurrence of jaundice. The fluctuations in particular are more dependent upon the changes in the volume of plasma. The "resistance" of the red corpuscles is the same at the time of birth as in the adult, and it is not altered in consequence of jaundice. Knopfmacher (*Wien. klin. Woch.*, No. 43, '96).

Icterus neonatorum is due to pathological causes supervening during the first moments of extra-uterine life, and not to physiological conditions attending the birth of the child.

On examining the liver in fatal cases venous stases and retention of bile in the bile-ducts was always present. The retention of bile is favored by anything which tends to prevent the full expansion of the lungs, or interferes with the free action of the heart, both of which conditions so frequently follow after a difficult labor. The jaundice develops most frequently about the third day, never appearing as early as the first, and rarely delayed as late as the fifth day. The duration of the illness is from six to fourteen days, and occurs, according to the author's investigations, 395 times out of 1000 newborn children. The icteric tint

is first observed on the nose and cheeks, and occasionally the face alone is jaundiced, the rest of the body remaining of a normal color. The color of the urine is unchanged in mild cases, but in severer attacks bile-pigment is present. There is often profound alteration of nutrition and slowing of the pulse-rate during an attack. Vermel (*Presse Méd. Belge.*, June 1, '98).

Weil's Disease (Acute Infectious Jaundice).

In 1886 Weil described "A peculiar form of acute infectious disease characterized by jaundice, swelling of the spleen, and nephritis." This has been recognized by German writers as a new disease. But others have looked upon it only as what has long been described as "acute infectious jaundice," a name that serves sufficiently to designate it.

Symptoms.—The disease presents the symptoms that characterize acute infections generally. It sets in suddenly, usually with chill, followed by fever, pain in the back and limbs, loss of appetite, thirst, general malaise, headache, giddiness, and usually diarrhœa. The symptoms increase for a day or two, the temperature rising rapidly to 104° or 105° F., weakness increases, and there is mild delirium. Jaundice appears on the second or third day, with marked enlargement and tenderness of the liver and swelling of the spleen. The urine becomes albuminous and shows the other signs of acute nephritis. There is marked derangement of the digestion—furred tongue, nausea, and sometimes vomiting. The symptoms begin gradually to subside by the fifth to the eighth day. The persistent high temperature falls, gradually reaching the normal by the tenth or twelfth day. The jaundice abates with the other symptoms.

Epidemic of icterus occurring especially among children noted. Reports of 518 cases collected in Saxony during the autumn of 1889. The initial stage lasted

three or four days and was characterized by fever, vomiting, constipation, and congestion of liver and spleen. The icteric stage appeared one or two days after defervescence and lasted about eleven days. Seventy-three per cent. of the children living in the region where the epidemic prevailed were attacked. Thirteen deaths were reported to the writer. Catarrhal conditions of the stomach did not predispose to the disease, while disorders of the respiratory tract, and especially influenza, did. It appeared to be both contagious and miasmatic. Meinert (*La Semaine Méd.*, Aug. 27, '90).

Small epidemic of icterus among children attending the same school, but living in houses far apart. The attack commenced suddenly, with vomiting, prostration, headache, vague gastric pains, and, in the course of three or four days, intense icterus. The whole process lasted ten to twelve days. Denton (*Revue Méd. de la Suisse Rom.*, Oct., '90).

An infectious icterus resembling typhoid in its clinical appearance. The phenomena are ushered in with pain in the head and limbs, the temperature gradually rising till it reaches 102.2° to 103° F., which height continues five to eight days. On the fourth or fifth day icterus appears, the spleen is enlarged, and the margin of the liver is prominent and painful. The tongue is coated. The urine contains albumin from the beginning, but becomes dark on the fourth day, although the fæces are normal and sometimes colorless. The duration of the disease is between two and three weeks. It usually terminates in recovery. Two fatal cases, however, are on record. The necropsies revealed great reddening and swelling of the solitary follicles. Hoepfner (*Med. Press and Circular*, July 23, '93).

Infectious icterus studied in 96 cases observed in children from one to thirteen years of age. The onset was sometimes insidious, but usually was sudden and accompanied by fever, headache, and chills. Jaundice appeared ordinarily on the third or fourth day, sometimes at the end of a week. The urine became highly colored; the stools, pale. In only 3 cases did the urine contain a small amount of albumin. The liver and

spleen were ordinarily increased in volume and were painful to pressure. Slowing of the pulse was noted in only 3 cases. Temperature was usually elevated during the first three or four days. The duration was three or four weeks. Of the 96 cases, 6 died, all of them with symptoms of cholæmia. Kissel (*Jahrbuch f. Kinderheilk.*, B. 48, S. 235, '99).

Two clear cases of Weil's disease in both of which the Widal reaction was positive even in as strong a dilution as 1 to 1000. The reaction is often positive in jaundice from any cause; it does not seem to be the bile alone, but some combination of the bile with the blood which is able to produce agglutination. Yet this does not explain these two cases, for the reaction was much too strong to be referred to the icterus alone and was still present when this had already disappeared in almost the same strength. Though the presence of jaundice and nephritis, such as occurs invariably in Weil's disease, strongly militates against the diagnosis of typhoid, yet the author is inclined to regard the disease merely as a peculiar, abortive type. T. Eckardt (*Münchener med. Wochen.*, July 8, 1902).

Convalescence is usually uninterrupted, but in a certain number—about one-fourth—the fever recurs within a week, lasting five or six days, in only a few cases being accompanied by recurrence of jaundice, swelling of the liver and spleen, and albuminuria.

Convalescence is always slow, the strength not being restored for many weeks.

Of the symptoms, the most marked usually are the muscular pains, especially in the calves of the legs. The pains may be so severe as to obscure the other symptoms. They are much increased by movement and by pressure of the muscles.

Etiology.—It is met with usually among males between the ages of fifteen and thirty years, but has been seen in children as young as eight. It occurs

usually in endemic outbreaks in summer, affecting chiefly workmen engaged in insanitary occupations or environments. It is rare in America. It doubtless belongs to the group of toxæmic jaundice, but as to the nature of the infection, whether specific or multiple, is still to be determined. In two out of three fatal cases Jaeger found a bacillus of definite characters in the organs of the body, and in the urine of four out of six cases that recovered, the same organism was found. Ducks and geese—frequenting the river in which these cases were supposed to have acquired the disease by bathing—were subject to a fatal form of jaundice, and in them similar post-mortem changes and the same organism were found.

Group of cases of epidemic jaundice, eleven in number, which occurred in five families living in Parkhead, Glasgow. Russell (*Brit. Med. Jour.*, Aug. 11, '88).

Infectious icterus is a general acute specific-infectious, miasmatic, non-contagious disease. It may be sporadic, epidemic or endemic, and, as a rule, runs a favorable course. It stands, in some way, in a certain relation to typhoid fever and to typhus biliosus. The infectious agent arises outside of the human body. The disease never relapses. Hennig (*Volkmann's Sammlung klin. Vort.*, No. 8, '90).

Case showing analogy between Weil's disease due to proteus and icterus neonatorum. Bar and Rénon (*Comptes Rendus Hebd. des Séances*, etc., May 24, '95).

Infectious icterus due to a proteus infection. Doubts concerning Banti's new bacillus. Jaeger (*Deutsche med. Woch.*, Oct. 3, '95).

Experimental study of Weil's disease, or acute infectious jaundice. Very few cases have been recorded in America, probably because the meat-supply is good. The source of the infective agent is almost certainly putrid or decomposing meat, or water tainted thereby. From a fatal case the writer isolated a bacillus closely allied to, but not absolutely identical with, the bacillus proteus found by Jäger in cases of Weil's

disease. This micro-organism, when injected into monkeys, guinea-pigs, or mice, produced acute parenchymatous degeneration of the liver and kidneys, but did not set up jaundice. His experiments bear out the clinical observations that the bacillus is found in the blood in small numbers or not at all, that dissemination takes place chiefly by the lymphatics, and that it is excreted by the urine. The disease closely resembles mild forms of yellow fever, and it is possible that the diseases are really one, and that the modifications in frequency, course, and severity are largely due to altered dietetic and climatic conditions. Harlow Brooks (*Archives of Neurol. and Psychopath.*, Oct., 1901).

Morbid Anatomy.—The liver-changes resemble those found in acute yellow atrophy, but to a much less degree. There is fatty degeneration and cloudy swelling of the renal epithelium, or even an acute parenchymatous nephritis. Minute hæmorrhages exist in various organs and on the serous surfaces. The spleen is swelled. There are no traces of typhoid ulceration.

Case of Weil's disease in which the post-mortem showed bilateral hæmorrhagic nephritis, œdema of the lungs, and hyperæmia of the mucous membranes in general. The liver was a pale-yellowish-brown color, was not enlarged, and contained a moderate amount of fat. W. Richter (*Deut. med. Woch.*, Oct. 26, '99).

Prognosis.—Only a small number of cases have terminated fatally, but convalescence is protracted.

Treatment.—This is quite symptomatic. The pains will require anodyne for their relief.

ALEXANDER MCPHEDRAN,
Toronto.

JAWS, DISEASES OF.

Alveolar Abscess, or "Gum-boil."

A gum-boil usually begins in the socket of a carious tooth. It is generally quite superficial, and gives rise to but few external signs, but occasionally, espe-

cially when due to a disorder at the root of a tooth, the active manifestations are accompanied by severe throbbing pain, considerable swelling of the cheek of the corresponding side, and with protrusion of the tooth from thickening of the periodontal tissues. When the lateral incisors are involved, the abscess may spread posteriorly between the layers of the hard palate, or anteriorly in the direction of the nose, opening into the latter. When the molars are involved, it may penetrate the tissues of the face, thus leaving a sinus or scar. Necrosis and pyæmia have occurred in rare instances as complications.

The process in the bone in alveolar pyorrhœa is one of osteitis rarefaciens. It does not develop primarily in the bone, but subsequently, commencing as a purulent inflammation of the gums, which gradually extends to the bone and produces the pathological condition. The osteoporotic form of atrophy of the alveolar processes leading to complete loosening of the teeth, so far undescribed, has been up to the present looked upon as alveolar pyorrhœa without suppuration or deposit of tartar. It is on account of this form that Baume and others erroneously maintained that pyorrhœa alveolaris may commence primarily in the bone in the absence of any inflammation of the gums. The osteoporotic form of atrophy of the alveolar process presents a very favorable soil for the development of pyorrhœa alveolaris. Various pathological conditions of a constitutional character, as scrofula, rachitis, syphilis, tuberculosis, acute eruptive fevers, typhus, malaria, diabetes mellitus, tabes dorsalis, rheumatism, gout, chronic catarrh of the stomach, anæmia, chlorosis, unsanitary dwelling, insufficient nourishment, repeated pregnancy, and other debilitating diseases lead to general atrophy of the soft parts of the organism as well as the skeleton and particularly the alveoli. These debilitating conditions create in the bone a favorable soil for the development of pyorrhœa alveolaris,

particularly in the form of osteoporotic atrophy. The lack of proper hygienic attention to the teeth during the above-mentioned constitutional diseases leads to a deposit of tartar, and suppurative inflammation of the gums, which extends to the bone-forming alveolar pyorrhœa. In the mild forms of pyorrhœa, when only the parts of the alveoli which do not contain bone-marrow are attacked, more attention to the teeth, removal of the tartar, washing with some disinfecting and astringent solution, and correction of the diet are sufficient to effect a cure. In more advanced cases the above treatment is inadequate, and scraping the affected bone with a sharp spoon is the only radical and rapid method of treatment. In the presence of constitutional diseases it is essential to employ in addition to the local also general treatment. In view of prophylactic and hygienic measures for the prevention of the disease, chewing of solid food, such as a hard crust of bread, is advisable as a means of gymnastics tending to improve the nutrition of the alveoli and strengthening the gums and teeth. N. N. Znamensky (Med. Obozreniye, vol. lvii, No. 6, 1902; Phila. Med. Jour., Oct. 11, 1902).

Treatment.—The old-fashioned linseed-meal poultice is worse than useless; it tends to encourage the inflammatory process and to involve the cheek. Hot water as hot as can be borne held in the mouth is far better. Painting the gums with a 10-per-cent. solution of cocaine is sometimes temporarily effective in mild cases. Free leeching or lancing can be resorted to if the abscess progresses. Leeches should always be applied through leech-glasses, and not wrapped in a napkin, as often done. If these measures do not suffice the patient should consult a dentist.

A broach wound with a wisp of cotton dipped in trichloroacetic acid should be taken, and the acid pumped through the opening on the gum. Care should be taken not to allow any of the acid

to come in contact with the mucous membrane of the mouth, as it will burn and cause considerable discomfort. The small quantity coming through the opening on the gum does not trouble the patient, although it causes a whitening of the tissues immediately surrounding the opening. After injecting the acid, the tooth is sealed. Two or three days later the stopping is removed, the canal thoroughly washed out with hydrogen dioxide, and the treatment repeated. Almost all cases will yield to two treatments. C. C. Noble (Dental Register; Treatment, Apr., 1904).

Epulis.

Although applied to various neoplasms of the gums, the term "epulis" is only applicable to a growth of the alveolar process and tooth-sockets. Two varieties of epulis are recognized: the *simple*, or benign; and the *malignant*.

SIMPLE EPULIS.—A benign epulis is, in reality, a fibroma: a smooth, rounded projection of the gum, usually beginning between two teeth, which it gradually separates, displaces, and loosens. It may involve several teeth and involve the posterior or the anterior aspect of the alveolus. It is painless, of slow and indolent growth, but, if left to itself, it ulcerates and causes marked deformity. It sometimes ossifies.

MALIGNANT EPULIS.—This is a much more dangerous variety. Beginning usually at the socket, it is characterized by the presence of irregular multinucleated mass of giant-cells associated either with round or spindle cells, or both. It is really a myeloid sarcoma. It is exceedingly vascular, purplish red, grows much more rapidly than the simple epulis, and is finally transformed into a spongy mass, which projects in various directions and bleeds upon the least contact with a hard substance.

Epulis is almost always a giant-cell sarcoma, though it may be of either a

hard or soft consistency. The careful microscopical examination of some seven cases demonstrated that the giant cells are not independently-developed cells, as has been generally believed, but are protrusions or buddings from the blood-vessels, whose endothelium is directly connected with the protoplasm of the giant cells, and the capillaries from which the giant cells sprang were not always empty, but frequently filled with blood. The second constituent of the epulis—viz., the spindle-cell sarcomatous tissue—is very frequently seen to be connected with the giant cells and at the other times with the capillaries, so that the spindle cells also, without doubt, develop from the blood-vessels; indeed, it is probable that these cells are, in reality, collapsed capillaries lying closely against one another. The blood-spaces found in epulis are not hæmorrhages from the frequent traumatism to which the growth is submitted, but are, in reality, venous sinuses, into which the arterial system sends capillary sprouts. Carl Ritter (*Phila. Med. Jour.*, from *Deut. Zeit. f. Chir.*, Dec., '99).

TREATMENT OF EPULIS.—Whether the growth present be a simple or malignant one, the sooner it is removed the better. The tumor, and the tooth or teeth and the portion of the alveolar process involved, should be cut out, this constituting the only safe mode of treatment. Mere scraping is followed by a return of the tumor in almost every case, whether simple or malignant. The portions of bone to be removed being mapped out, two vertical incisions are made with a Hey saw, and the diseased mass is removed with forceps, after having been dissected from its surroundings.

Four cases of epulis personally operated upon, in all of which an attempt had been made to remove the growth without sacrificing the teeth, and in all there was prompt recurrence. Thus far the prompt removal, after drawing the teeth from whose base the tumor had sprung, has been effectual, and was likely to continue so. All cases of tumor of this kind re-

moved at the hospital from 1878 to 1888 have been followed, and neither recurrence nor death has occurred. Where the growth appears on both sides of the alveolar process, at least one of the teeth, and often both, must be drawn to give free access to the periosteum. In this disease the dangers of palliative delay are not great, on account of the fact that it has, in the beginning, at least, only local malignancy. M. H. Richardson (*Boston Med. and Surg. Jour.*, Oct. 2, '90).

Conclusions from observations of epulis: 1. In none of personal cases of epulis have evidences of general or secondary invasion been observed, and it has been sufficient to remove the tumor and to extract the roots or teeth with which they were connected to cause the arrest of the disease. 2. In all cases treated there has been a great neglect of the hygiene of the mouth. This has been the case especially with persons working in copper, or cutlers, whose teeth accumulate a characteristic tartar which appears to predispose them especially to these neoplastic formations. F. D. Rodriguez (*Cronica Médico-quir. de la Habana*, Oct., '90).

Necrosis.

Necrosis of the jaw may be due to any condition liable to give rise to inflammation of its periosteum by injury due to extraction of teeth, by various suppurative diseases, the acute exanthemata, pyæmia, actinomycosis, etc., or by the action of various diathetic processes, such as syphilis, tubercle, or leprosy. It is most frequently caused by the fumes of phosphorus (see beyond), and by mercury taken internally. Deficient nutrition, scorbutus, or other conditions in which the organism is deprived of its vital pabulum frequently manifests necrosis of the jaws as a symptom. It may thus occur at any age, and does seem to show a predilection for either the upper or lower maxillary.

Necrosis is always preceded by deeply-seated and intense pain; the parts are red, inflamed, and tumefied. After a time the pain is somewhat reduced and

sinuses are formed, from which a foetid pus exudes. The teeth are loosened and fall out, and the cavity left is bathed in pus. A probe passed in any of the sinuses reveals the presence of dead bone by conveying to touch the characteristic sensation of roughness. Portions of the bone become detached and are easily removed.

Case of a boy, aged 6 years, taken sick with influenza in December, 1889. During convalescence foetor and swelling of the mucous membrane of the right cheek noticed. Fever set in on the fourth day, and a gangrenous area was noticed which spread rapidly to the right half of the upper lip and invaded with special violence the osseous portion of the upper jaw. The whole of this bone was completely carious. The face on the right side presented an enormous œdema, which hid the eye completely. There was an abundant and foetid salivation and an odor of cadaveric putrefaction.

Complete excision of the diseased upper jaw was performed by which the whole of the osseous lesion was removed. The gangrenous soft parts were partially removed and burned with the Paquelin cautery, and the cavity packed thoroughly with iodoform gauze. In two months there was complete recovery without marked deformity. Christovitch (Bull. Gén. de Thér., Nov. 15, '90).

Difficult and complicated deformity of the lower maxilla, resulting from long-standing necrosis and caries, of doubtful origin, successfully treated. The patient, a male aged 40 or 45 years, lost the two lateral halves of the lower jaw. In consequence of this the anterior portion of the horseshoe, formed by the jaw, which had yet attached to it the incisors, the canines, and the molars of each side, was thrown backward in an inclined position downward, which made it impossible for the teeth to meet, and also caused a very ugly retraction of the chin. By means of splints and plate, and subsequent modifications, excellent results were obtained, in spite of the carelessness of the patient and many obstacles which seriously interfered with the prothetic treatment. Martin (Lyon Méd., Mar. 27, '92).

Phosphorus Necrosis.

Symptoms.—Phosphorus necrosis comes on gradually, and sometimes long after the patient has been exposed to its toxic influence in connection with his occupation, the manufacture of matches, etc. But, once started, it progresses rapidly, involving large areas of bone; owing to the general toxæmia, many foci of inflammation may be developed at once. The lower jaw seems to be that in which phosphorus necrosis most frequently occurs.

Pain is one of the earliest symptoms; at first intermittent, it soon becomes continuous. Suppuration of the perialveolar and peridental membranes occurs, pus appears at the alveoli, and the inflammation soon includes the gum-structures, the tissues of the face becoming infiltrated, and the characteristic deformity appears. The entire periosteal layer is then invaded, sinuses are formed, opening into the mouth and externally under the lower maxillary edge; and pus is exuded on all sides. The pain becomes less marked when this stage is reached, unless the necrotic process involve the condyle, when severe pain in the ear is experienced.

The general health of the patient soon suffers considerably. The constant discharge, the presence of offensive pus in the mouth and stomach (much of the discharge being swallowed), the occlusion of the jaws through infiltration of the maxillary muscles and the impediment to the ingestion of food, combine to rapidly bring on exhaustion and death unless proper treatment be instituted.

In some cases, however, the process is a slow one, and comparative health is enjoyed while now and then a necrotic sequestrum is discharged through one of the sinuses.

In some operatives, however, a special

susceptibility to phosphorus exists, and acute symptoms—nausea and vomiting, etc.—indicates an acute poisoning that requires immediate cessation of all work in which phosphorus is handled or inhaled.

Etiology and Pathology.—The inhalation of the vapor of phosphorus and the particles of this substance taken in with the food when the hands are not properly cleansed and improper care of the teeth combine to very gradually bring on the general toxæmia. This, in turn, gives rise to slow disintegration of the red blood-corpuscles and fatty degeneration of the arterial coats. That the maxillary bones should, of the entire osseous system, bear the brunt of the disease demonstrates that a local factor must play a prominent part in the disease. It is thought that the peridental membrane laid bare by accumulation of tartar, and whose vascular supply is already diseased by the general toxæmia, is easily influenced by any phosphorus that may enter the mouth, and thus readily yields to the irritation induced, carious teeth and other infectious foci, and that the necrotic process follows the local inflammation engendered.

The so-called phosphorus necrosis of the jaw in match-workers is due to an infection from micro-organisms. In 6 cases examined various organisms were found, none of which could be said to be specific. Tubercle bacilli were found in every case, moreover; and when death occurs, it is usually due to tuberculosis of the lungs. The condition is really a tuberculosis of the bone, ingrafted upon a primary lesion, caused by the corrosive action of the phosphorus. Stockman (Brit. Med. Jour., Jan. 7, '99).

Phosphorus-vapor exerts no specific irritating influence on the bared periosteum of guinea-pigs, rabbits, or dogs; so that the clinical picture of phosphorus necrosis of man cannot be reproduced experimentally in these animals, and the

condition must be considered as peculiar to man. Stubenrauch (Archiv f. klin. Med., B. 59, H. 1, '99).

Treatment.—In the early stages the teeth should receive careful attention, carious ones being extracted, while the tartar around those not diseased should be carefully removed. These manipulations should be conducted antiseptically, strict care of the teeth following.

Turpentine, according to Hohler and Schimpf, when exposed some time to the air becomes rich in ozone, and prevents fatty degeneration. Theoretically, it is thus capable of neutralizing the effects of phosphorus: a power which has also been demonstrated practically. Andant found that it arrested the vapor of phosphorus in the dark. The ordinary American oil of turpentine is of no value, however, unless it be long exposed to the air. It is to be administered internally and by inhalation. Potassium permanganate is also a valuable antidotal agent. The general health should be carefully watched and every means used to facilitate increased nutrition by the use of tonics and easily-digested foods.

In the stage of ulceration antiseptic washes as warm as possible should be frequently used. A weak permanganate-of-potassium solution is particularly valuable in this connection, when syringed into the sinuses. This being done, iodoform gauze can be packed in to absorb secretions to avoid their mixture with food. Sequestra should be removed when free, and the cavity packed. Mears advises that, when the lower jaw is involved, but half of the ramus should be removed at one time, to preserve the contour of the parts. After the expiration of eight or ten weeks the remaining portion may be removed.

New method of operating in the treatment of phosphorus necrosis of the lower jaw. Two sittings are required for opera-

tion. In the first operation an incision is made along the lower border of the jaw, by which all the soft parts, including the periosteum, are incised to the bone; the periosteum is completely detached, together with the osteophytic layer, until the necrosed bone remains bare. A very thin layer of iodoform gauze is then introduced between the bone and the periosteum. Five weeks later the necrotic bone is excised. During this time the periosteum has become a firm bony capsule, which has the shape of the jaw, so that outline of the maxilla is preserved after the removal of the sequestrum. K. Jervell (Norsk Mag. for Lægevid., '89).

Case of phosphorus necrosis of the left superior maxilla, in which the necrosed jaw was successfully removed by subperiosteal and intrabuccal operation. Fusci (Riforma Med., Apr. 27, '91).

Value of hydrogen peroxide extolled in the treatment of alveolar necrosis of jaws. Cassel (Deut. med. Woch., p. 554, '89).

When the patient cannot avoid exposure to phosphorus-fumes, the preventive measures should consist in free ventilation, absolute cleanliness, especially of the mouth and hands, and disengagement of the vapor of turpentine in working-rooms. Cloths may be soaked in this substance and spread out close to where the exposed subject is working.

JEQUIRITY.—Jequirity is the Brazilian name given to the seeds of the *Abrus precatorius*. *Abrus*, or wild licorice, one of the leguminosæ, is a climbing shrub indigenous to India, but now naturalized elsewhere in the tropics. The seeds, or beans, are small, nearly round, of a bright-red color, with a black spot at the hilum, are inodorous, and have a slight bean-like taste. They are employed in India as a standard weight (about $1\frac{1}{2}$ grains). Warden and Waddell, of Calcutta, claim that the seeds are inert when taken whole into the stom-

ach. The seeds contain abric acid and an albuminoid active principle (abrin), which is composed of paraglobin and alpha-phytalbumose, which closely resemble snake-venom in their action, though less powerful. Abrin occurs as a brownish-yellow powder, soluble in cold water and in glycerin. It is precipitated from aqueous and glycerin solutions by alcohol. Abrin is a powerful cardiac poison. The root of the plant is official in the Pharmacopœia of India as a substitute for licorice.

Physiological Action.—Klein has shown that the poisonous properties of jequirity cannot be due to a bacillus, while Warden and Waddell found it to be due to the action of a poisonous proteid. The proteids in the seeds are two in number: a globulin and an albumose. S. Martin and R. N. Wolfenden found that globulin produces local œdema and inflammation when subcutaneously injected or applied to the eye (with post-mortem petechiæ beneath the serous membranes), and hæmorrhagic gastro-enteritis. It also causes a remarkable fall of body-temperature after subcutaneous injection, and in lethal doses it causes rapidity of breathing shortly before death. It has little or no effect on blood-pressure. The activity of this globulin is destroyed by heating the solution to 75° or 80° F.: the temperature at which it enters into a condition of heat-coagulum. Martin also found that the symptoms produced by the albumose closely resemble those noticed when the globulin is hypodermically injected. There is gradually-increasing weakness, with rapid breathing and lowering of body-temperature, but no convulsions or paralysis. It also causes severe conjunctivitis when applied to the eye. Its poisonous properties are lessened by heating at 70° to 75° F., and completely

destroyed at 85° F. The albumose is not, however, so powerful a toxic agent as the globulin, the dose necessary to produce the same effects being larger. A similarity between the action of the proteids and those of other poisonous substances of the same class, especially those in snake-venom, is suggested.

Poisoning by Jequirity.—An acute conjunctivitis follows the topical application of the infusion or powdered seeds. While pounding the seeds one is liable to an attack of conjunctivitis, rhinitis, or bronchitis, and any cuts or scratches on the fingers become swollen, painful, and the centre of an erythematous blush. The careless handling of abrin is extremely dangerous to the eye and the nose, and the smallest particle may be fatal in the slightest wound. Abrin is not used internally; it is very poisonous, $\frac{1}{100}$ grain being a fatal dose for a man of 130 pounds in weight. The lethal symptoms of the internal use or hypodermic injection of abrin are faintness, vertigo, vomiting; cold, clammy surface; dyspnoea; small, frequent, irregular pulse; convulsions, and collapse. Death occurs from cardiac paralysis.

Albuminous principle isolated from *Abrus precatorius*, which is 100 times more poisonous than strychnine, and acts in the same manner on the system as the poisonous principle extracted from castor-oil seeds. Death is caused by the coagulation of the blood-corpuscles. Kobert (Ther. Gaz., Feb., '90).

Treatment of Abrin Poisoning.—Cardiac stimulants, digitalis, amyl-nitrite, ammonia, and whisky are to be exhibited, and external warmth applied.

Therapeutics.—In this country jequirity has never been used internally in medicine. At present the use of jequirity is limited to those obstinate cases of granular conjunctivitis and pannus, especially the latter, which have resisted other modes of treatment. Its action is chiefly

by replacing an existing inflammation by another of stronger type, but of temporary duration. Although jequirity is said to have been used in Brazil for centuries as a popular remedy for granular cyclitis and pannus, it was de Wecker, of Paris, who, in 1882, revived interest in the remedy by the publication of reports of its successful use in his practice. He recommends its use as follows: Powder 32 jequirity-berries and macerate them for twenty-four hours in one pint of cold water; add an equal quantity of hot water, and filter when cool. Sattler advises that the husks of the seeds be removed by means of hot water before the infusion is made. The seeds are then powdered and 6 fluidounces of hot water added. This infusion is allowed to stand for twenty-four hours, when it is filtered. Andrews recommends that the husks be rejected, the berries ground and macerated for twelve hours in cold, distilled water, and that then the infusion be filtered, care being taken that the preparation be made in a clean vessel and the maceration be conducted in a cool place. In any case, the solution should be used while fresh. Decomposition renders it unfit for use, and dangerous.

Any one of the above infusions being selected, a portion is painted on the conjunctival surface of the eyelid with a brush. This procedure is followed by an acute diphtheritic inflammation, lasting three or four days, and attended with fever and pain in the eyes and in the frontal region. This so changes the chronic process present as to permit of a cure. If an excessive action is developed, it may be controlled by hot compresses made of very dilute solutions of corrosive sublimate (Hare). If the first application gives rise to but slight reaction, it may be repeated after an interval of twenty-four hours.

De Wecker reported that the jequirity inflammation was peculiar in that it did not tend to spread to the cornea or other tissues, but was confined to the conjunctival sac to which it had been applied. Instances, however, have been reported where the inflammation spread to the face, neck, and the upper part of the chest. Warren and Waddell report a case of sloughing of the cornea from a single application of a somewhat concentrated infusion of the seeds. An infusion (3 per cent.), prepared with cold distilled water, prepared fresh, and used while fresh, is advised.

Purulent conjunctivitis contra-indicates the use of jequirity.

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JOINTS, SURGICAL DISEASES OF.

Varieties.—The affections to which joints are liable are almost all due to inflammation and its results. Their character varies according to the causes which originate them and the extent to which the disease progresses. If the inflammatory action is confined to the lining membrane of the joints, then it is designated as a *synovitis*. If, however, it goes farther, and involves the remaining structures in addition, then it is spoken of as an *arthritis*. If pus is a prominent symptom, it may be called a purulent synovitis or arthritis, although when this occurs it is more apt to be regarded as an arthritis. Micro-organisms play an important part at times in joint-inflammations. These are usually of the ordinary pus-producing kinds, such as produce suppuration in ordinary wounds, or sepsis. When this is the case, one speaks of a *septic arthritis*. If the exact source of the infection is known, then the specific cause of the affection results in naming it according to its origin. Thus one

speaks of *rheumatic*, *gouty* or *tubercular arthritis*, also of *gonorrhæal* or *syphilitic*. Sometimes a special name is given, such as *osteoarthritis*, not indicating its origin, but rather the parts affected; also *Charcot's disease* of the joints, so named after him who described it.

Loose bodies in joints occur as the result of injury or disease. When the disease affecting a joint pursues an extreme course, the functions of the joint are destroyed and it may no longer bend. This state of more or less complete fixation is called *ankylosis*, and, after the diseased process has died out and entirely ceased to act, it alone remains and may be the cause of the patient's seeking the surgeon and demanding relief.

Synovitis.

Synovitis is the name given to a simple inflammation, which is supposed to be limited to the synovial membrane. It is apt to be incorrectly applied, at times, on account of other structures of the joint being affected at the same time. The term simple synovitis is of considerable service to designate those inflammations which cannot be traced to specific irritants, such as gout and rheumatism, nor to disease of contiguous structures, such as the bones.

Symptoms.—The symptoms are those common to inflammations in general, such as pain, heat, redness, and swelling, with impairment of function, as well as others due to the peculiarities of the special structure or part involved.

ACUTE SYNOVITIS.—In acute synovitis the pain may vary from slight to excessively severe. The rapidity with which the effusion may occur can cause intense pain by distension of the joint-capsule. The joint may be red and hot to the touch and very tender. The swelling is due mainly to distension of the joint, both by the increase in size of

the synovial fringes and to the increased effusion. Swelling is a most important symptom, and it is much more marked in some cases than in others. In such joints, as the knee, that are not deeply covered by soft parts the swelling is marked and peculiar in shape, while in those which are not so superficial, as the shoulder and hip, it may be so slight as not to be evident. In these latter joints there may be a slight uniform enlargement which it would be difficult to say was not due to the bruising of the soft parts in case the affection followed an injury. In the knee and ankle, on the contrary, the swelling may be marked, and follow accurately the outlines of the joints. It is influenced in its shape by the overlying structures. Thus, in the knee-joint the swelling of the synovial fringes below the patella causes a protrusion at that point, which is more marked on each side of the tendo-patellæ. There may be a swelling above the patella or on each side. The patella is likewise lifted up away from the femur by the effusion, forming the so-called floating patella; or, pushing the patella downward, it can be felt to strike against the condyles beneath. When the subfemoral bursa communicates with the joint, the swelling often extends quite a distance above the patella. In the ankle-joint the swelling is more toward the sides, but is also seen in front. Behind, it is not so marked except on each side of the tendo Achillis, which, however, does not play so prominent a part in the symptoms of affections of this joint as do the patella and its tendon in those of the knee. In the elbow the tendon of the triceps muscle also causes the swelling to be more marked on each side than in the middle. Impairment of function is usually marked, and movements are very painful in the acute type of the affection.

Not only does pain interfere with the joint's functions, but the effusion into and distension of the joint prevents it from performing them by rendering it looser and less secure; so that weakness is marked, and, even if pain is absent, the joint is practically useless.

SUBACUTE SYNOVITIS.—In subacute synovitis the symptoms may be less abrupt in their onset and less violent in character. An acute attack may be slow in subsiding or the affection may be mild from the start. The heat, pain, and redness are not so marked as in the acute type, and the antiphlogistic measures of treatment are not required to be so pronounced.

CHRONIC SYNOVITIS.—In chronic synovitis the symptoms are characterized by their persistence. The acute pain gives way to a dull persistent pain, aggravated by use of the joint to such an extent as to forbid it entirely. The redness may disappear, the heat may be slightly or not at all above that of the opposite side, but the swelling usually remains and forms a most prominent symptom. The swelling of the membranes of the joint may overshadow the effusion, and then the joint has a boggy or doughy feel, which is highly characteristic. The swelling may be very great, due to the large amount of effusion. Effusion of lymph is most apt to occur in the violent inflammations of acute attacks. Pus does not often occur in cases of simple synovitis, because infection is lacking. Should this, however, from any cause take place, then it forms quickly enough. The existence of chronic synovitis implies disuse of the member affected for a considerable time. Trophic changes therefore occur which produce a marked condition. The muscles above and below the joint atrophy, while the joint remains swelled, and each tends to ag-

gravate the appearance of the other; so that together they form a picture of helplessness which is amply borne out by the total inability of the patient to use the joint. If a joint of the lower extremity is affected, the patient is compelled either to refrain from walking or hobbles about only with the greatest difficulty, while if the upper extremity is involved the arm is usually carried in a sling.

Joint inflammation is not uncommon in the infectious diseases. Review of 14 cases in which synovitis occurred during scarlet fever out of 506 cases in five years. The joint affection appears in the first or second week of scarlet fever, about the beginning of desquamation in severe cases, with pain and some added elevation of temperature. Swelling was only observed in 5 cases. The symptoms generally disappear inside of a week. Six of the cases had two attacks; one case had three. The wrist was affected 8 times, the elbow 7, knee 5, ankle 4, and the hip and shoulder once each. In 10 of these it occurred on both sides of the body. Homa (Wiener klin. Wochen., March 21, 1901).

Etiology.—The principal cause of simple synovitis is injury. The joint may have been knocked, bruised, or strained. Exposure to cold and wet may be followed by a simple inflammation of a joint, with no other evidences of rheumatic or other constitutional affection. Sometimes the disease seems to appear without immediate cause, but in these cases the affection has probably been the result of an injury so slight as not to have attracted the attention of the patient at the time or else have been since forgotten.

Pathology.—The affection consists of an inflammation of the synovial membrane of the joint with an outpouring of synovia, serum, lymph, or pus into the joint-cavity.

The joint-surfaces may lose to some

extent their smooth, glistening character, the synovial fringes become injected and begin to proliferate and tend to encroach on the interior of the joint and the surrounding cartilage. The natural secretion of the joint may become increased, it may contain lymph or even pus. In a quickly-occurring synovitis the secretion may be thinner than normal, owing to the sudden outpouring of serum. Not infrequently the injury which has produced the synovitis may likewise have caused some bleeding into the joint, in which case the contained fluid will be blood-stained or consist even of blood-clots.

Treatment.—The treatment of synovitis varies with its acuteness. In a sharp attack constitutional disturbance may be marked, the pain is severe and fever high, the patient is tortured by suffering and deprived of sleep. The usual antiphlogistic treatment is here of service; a free saline purge is of service aided by acetanilid or phenacetin. To produce sleep sulphonal or trional may suffice, or if the pain is more severe Dover's powder or other opiate may be given in sufficient quantities to procure rest.

Local treatment is all important. Complete rest of the part is essential. If the knee is affected sand-bags may be placed on each side or a pasteboard splint on the back of the leg fastened by adhesive straps above and below the joint, leaving the latter exposed for treatment. A cradle should be used to prevent the bedclothes from touching the part.

In the treatment of acute synovitis by adhesive plaster, the following is usual plan of procedure in acute synovitis of the knee (which is the joint most commonly involved): The limb being in the position of greatest possible extension, a pad of cotton wadding or absorbent cotton is carefully and smoothly placed back of the knee, well filling the popliteal

space and covering the hamstring-tendons; next, sheet cotton (cotton batting) torn or cut into ordinary bandage-width is wrapped around the limb from six or eight inches below to the same distance above the patella; then strips of rubber adhesive plaster, one inch wide and long enough to more than encircle the limb, are applied over the soft, cotton dressing as follows: Beginning four to six inches below the joint, according to the size of the limb, the leg is encircled like a garter with a strip of the plaster, which is drawn quite snug and the ends stuck together; above this, and overlapping one-third, a second strip is applied; and so on, strip next to strip, each overlapping the one before, drawing them snug and sticking the ends together, until the joint and from four to six or more inches of both leg and thigh are incased in a firm, adhesive plaster support. Over all a muslin bandage is applied.

When the plaster becomes loose, in consequence of the subsidence of swelling, it should either be made snug again by applying additional strips, or, better still, entirely removed and a new dressing applied. The results obtained by this method are remarkable. Hoffmann (*St. Louis Med. and Surg. Jour.*, Feb., '96).

Cases of gonorrhœal, influenzal, streptococcic, and pyæmic synovitis treated by incision and irrigation. In cases of synovitis not associated with rheumatic fever some septic source must be carefully looked for. If a joint becomes distended with fluid, associated with a rise of temperature, it should be opened, washed out, and sewed up, unless improvement be noted in a few days. Wallis (*Brit. Med. Jour.*, Jan. 3, 1903).

Bleeding has gone somewhat out of fashion, but a few Swedish leeches or the application of a few wet cups will give quicker results than almost any other means. The cases in which one will be inclined to use those means are, however, few. Ordinarily an ice-cap may be applied, but in other cases hot applications, such as woolen cloths wrung out of hot water, or hot-salt bags, or a hop poultice made by heating hops in a pan,

moistening them with vinegar and enclosing them in a bag, or even the use of the ordinary rubber hot-water bottle.

Personally I am partial to the use of the splint and ice-cap, and then when the pain and tenderness have somewhat subsided light massage may be employed. Massage is not used to anything like the extent it deserves. Employed daily very lightly at first and afterward more firmly, I am convinced of its great efficacy.

Obstinate cases of subacute and chronic synovitis I am convinced are best treated by absolute rest, as far as any use of the joint is concerned. The disease is often kept alive and troublesome because the patient persists in using the joint to the extent that the pain will allow him to. Massage is not incompatible with rest, but violent passive motion is. Therefore the joint may be rubbed to keep up its circulation and nutrition, but not irritated by bending. Hot-air baths are likewise of the greatest service to remove stiffness.

The question of tapping a distended joint to remove the effusion is an important one. I do not believe it correct to say that the procedure is without danger. On the contrary, it should be done in the most careful manner, or else the joint is apt to be infected and a serous effusion changed to a purulent one, with a possible disorganization of the joint. To properly tap a joint, the first thing is to get a sharp trocar the cannula of which is so closely fitted as to allow it to pass through a piece of leather without catching. Very few trocars stand this test, and all others are positively dangerous. It should be thoroughly disinfected—preferably by boiling. The part should be likewise thoroughly cleansed by scrubbing and antiseptics, the same as for any other serious surgical operation. The surgeon's hands

also require the same careful treatment. After tapping, the opening should preferably be sealed with collodion and gauze or cotton. If a bandage is applied with a dressing, the greatest care should be taken that it be so large and so firmly secured that by no possibility can it become displaced and the puncture exposed. Tapping done in this manner is of great service and not accompanied by much risk,—personally I have never had the slightest bad effects from it, but make it a positive rule to observe the greatest precautions against introducing infection.

Stiffness following synovitis, in which pain is not marked, may be treated by persistent, but not violent, passive motion and massage. If this is not successful, then a free movement of the joint under an anæsthetic may be tried, followed for a short time by complete rest and the ice-cap until reaction is past, when passive movements and massage, the use of the hot-air bath, the application, perhaps, of iodine to the joint or compression by a rubber bandage may be tried. Chronic joint-affections will tax the skill of the most experienced, and the surgeon must call on his ingenuity to devise means to achieve success.

Arthritis.

Arthritis is an inflammation of the entire joint, instead of only its synovial membrane as in synovitis. Clinically the difference is mainly one of degree. An inflammation that begins in the synovial membrane may involve the capsule, the cartilages, and eventually the bones. It is a more serious affection, more severe in its symptoms, more exacting in its treatment, and more serious in its prognosis. It may be started by an injury, by exposure, by infection either direct or by extension from neighboring dis-

eased structures, or by a constitutional cause.

Symptoms.—In arthritis the symptoms peculiar to synovitis are more marked; the fever is high if the disease is acute; the constitutional disturbance is severe; the swelling is marked; œdema may be present; the joint tender, particularly on its surface, as well as deeper in; it is flexed and rigid; the atrophy of the muscles is rapid; if it is moved grating may be heard, owing to destruction of the cartilage; and, as the disease advances, sinuses may form, bone may exfoliate, and even dislocations occur, with total disorganization of the joint. Sometimes the disease necessitates amputation or causes death. Often its course is very rapid. Infants are particularly liable to a form caused by extension of inflammation from the adjacent epiphysis, and it is productive of the most serious results.

In children a chronic progressive enlargement of the joints associated with general enlargement of glands and enlargement of the spleen, usually begins before the second dentition, the majority of the patients being girls.

The onset is usually insidious, but occasionally is acute, with rigors. The change in the joints suggests a general thickening of the tissues around the joint rather than a bony enlargement, and there is a striking absence of osteophytic outgrowths even when the disease has persisted for years. Redness and tenderness are present only in the more acute cases; but there is, as a rule, marked limitation of movement. The joints first affected are usually the knees, wrists, and those of the cervical spine. The sterno-clavicular joint was affected in two out of twelve cases, the temporo-maxillary in three. There is no tendency to suppuration or bony ankylosis. Wasting of the muscles which move the affected joints is a striking feature of the disease.

The glandular enlargement is general, but affects primarily and chiefly the glands related to the affected joints.

The glands are discrete, firm, painless, and show no tendency to break down. The enlargement is, to some extent, proportionate to the severity of the disease, and tends to diminish when the condition of the joints improves, and *vice versa*. The splenic enlargement is observed in a large proportion of the cases. It bears some relation to the degree of enlargement of the glands.

The diagnostic points indicating inflammation of joints are the rapidity of the occurrence of symptoms after the receipt of an injury, the presence of fever and local elevation of temperature, spasm of the muscles controlling the joint, constancy of painful and tender points, and sudden painful awakenings during sleep. R. H. Sayre (Med. Record, Dec. 9, '99).

There are four forms of disease of the knee-joint hitherto not sharply differentiated: 1. Arthritic muscular atrophy, which, on careful examination, discloses a severe atrophy of the extensor muscles of the thigh. The treatment of this condition consists in massage and gymnastics of the quadriceps muscle. 2. In the so-called *dérangement interne*, the lesions consist in a luxation or tearing away of one or both menisci of the knee-joint. For the diagnosis of this condition, an important element is the isolated sensitiveness in the knee space, and occasionally the dislodged meniscus can be palpated. The treatment is occasionally reposition, but operative measures are more certain, as is shown by the histories given. 3. Pain in the joint due to the development of a form of fatty tumor in the joint. The examination discloses a bulging below and on both sides of the patella. Excision of the tumor is the only treatment. 4. Free joint bodies in the knee, the presence of which can be determined by the Roentgen rays. Hoffa (Berliner klin. Wochen., Jan. 11, 1904).

Treatment.—The treatment of arthritis in its mild form is practically that of synovitis, which has already been detailed at length. It is, in the highest degree, desirable that the serious character of the affection be recognized as

soon as possible, in order that more rigid precautions may be taken than would be considered necessary in synovitis. It is more justifiable to resort to severe measures. The consequences of an arthritis are almost sure to be some limitation of the usefulness of the joint; not seldom does total stiffness ensue or the suppuration may be so marked as to demand resection or amputation to save life. If the disease is acute absolute rest in bed with the limb on a posterior splint (if knee is affected) is to be enforced, with the application of leeches, wet cups, or ice. Sometimes it is desirable to apply adhesive-plaster extension with weights. The amount of weights used is to be gauged by the patient's feelings. In the hip-joint particularly extension is necessary. In the ankle and shoulder plaster-of-Paris fixation-splints are of service, because in those joints movements are most apt to be marked.

Mechanical treatment should be commenced just as soon as the diagnosis of joint inflammation or disease has been made. If there be an acute attack, with great pain, it is advisable that the patient should be treated in bed for a few days until relief is obtained; but as soon as the pain has subsided and the deformity has been overcome, mechanical support should be applied. The object of the treatment is to restrict every motion of the joint and to effect extension in proper lines for the relief of intra-articular pressure. This pressure, which is produced by muscular spasm, is likely to result in destruction of the entire joint, necessitating either amputation or excision. The manner of application of fixation and extension is determined by a study of the mechanics of the various joints and of the action of the muscles involved. As they sustain the weight of the body, the joints of the lower extremities require very much more protection than do those of the upper extremities. Braces for lower extremity joints should

prevent the patient from stepping upon the foot, as by so doing the articular surfaces would be driven together and more inflammatory action and disease result. It is therefore advisable that any form of apparatus designed for the lower extremities, especially in the case of children, should extend at least two and half inches below the bottom of the foot, and should have a point of impact against the tuberosity of the ischium. By far the best supporter is one that has for its upper point of impact a steel ring properly padded. In the case of an adult with intelligence enough not to step upon the diseased limb, other appliances may be used. A. M. Phelps (Medical News, May 31, 1902).

Massage is indicated in spontaneous or traumatic acute arthritis when attended by serous effusion, or serous effusion tinged with blood; or where a fibrous exudate having already at the outset a tendency to form more or less firm adhesions about the articular surfaces and false ankylosis. It yields rapid and positive results after the first seance, already the pain and tumefaction are often diminished, and absorption is started, and in a few days a permanent cure is arrived at. Massage, as regards sprains, cures sooner than any other method; consequently there is less chance for persistent organic changes and less chance for relapse when one uses the limb. Even in tardy manifestations it gives excellent results. Chronic arthritis with serous or serofibrinous effusion is well adapted to massage. Massage is only useful in articular rheumatism, when the joint presents definite symptoms and these remain there; it is useless, as in muscular rheumatism, when the pains are vague and erratic. In gout the author uses massage only when the attack has subsided and the arthritis, or tenosynovitis, or bursitis with effusion remains and shows only very little tendency to become absorbed. Gustaf Norstrom N. Y. Med. Jour. and Phila. Med. Jour., Oct. 29, 1904).

Cartilage in a healthy state is not sensitive, but when a joint becomes inflamed

any pressure of the joint-surfaces together is productive of great pain and increases muscular spasm. Should the inflammation continue increasing, the joint should be tapped as described under the treatment of synovitis; instead, however, of merely allowing the liquid joint-contents to escape, the whole joint should be washed out. For this purpose sterilized salt solution, a saturated solution of boric acid which has been boiled, or a weak bichloride-of-mercury solution, 1 to 3000 or 1 to 5000, may be used.

If the inflammation increases and pus forms, then the joint will have to be drained. Drainage of the various joints is not apt to be a very satisfactory procedure. This is on account of there being no empty spaces for the drainage-tube to lie in. The bones touch each other and the interspaces are filled with the synovial fringes, while all are closely embraced by the capsular ligament. The knee-joint is the one most commonly treated by drainage. One of the best methods is to pass a tube into the joint just below the patella and to the inner side of the median line. It is then carried between the condyles and made to emerge posteriorly to the outer side of the popliteal vessels. Another way is to insert one on each side of the patella and another well back in the joint from side to side. The joint, however, is such an intricate one that good drainage is very difficult, and if the disease increases something further may have to be done. The choice will lay between amputation or resection and some form of arthrotomy. The recuperative powers of childhood are so great that conservatism is far more judicious than is the case in youths and adults. In young children partial procedures are often preferable to more radical ones. Resections in them give extremely bad results on ac-

count of the interference caused with the growth of the limb. The disability and deformity which at the time of the operation may have been comparatively slight can become so severe as to make a subsequent amputation desirable. Amputations are resorted to only as a means of saving life in children, but in adults the probability of a good result after very extensive bony disease is so slight that in them amputation is justifiable where in a child resection would suffice. In adults, also, resection of a joint is resorted to earlier than in children. If a marked purulent arthritis once becomes established in an adult resection is often demanded, and it is not advisable to defer operating until extensive disease of the bones is present. After pus once forms in the joint of an adult the joint is very apt to remain stiff even if cure occurs, whereas the result after a resection is no worse and the course of the disease is much shortened. One does not have to fear subsequent deformity due to the disparity in growth of the two limbs. In very young children formal resections may give way to atypical operations, in which the disease foci are gouged away and even some cavities deliberately cleansed out and packed with gauze and left to granulate. Even these partial operations should not be undertaken until the disease is marked.

Twenty-eight cases of operations upon joints in which the joint was opened, and in but one was subsequent amputation found necessary. Bruce Clark (Illus. Med. News, Dec. 14, '89).

Drilling into the bones in the neighborhood of inflamed joints and injecting carbolic acid, 1 in 40, recommended, thus relieving pain and hastening recovery. N. Smith (Brit. Med. Jour., Feb. 22, '90).

The failure of general health is the best indication for operative procedures. In children up to the age of about five years even free suppuration of a joint

may often be cured without severe operations. A great deal depends on the mechanical ability of the surgeon to handle these cases conservatively.

Arthrectomy, or erosion, is the scraping, or curetting, of the joint with the removal of the synovial membranes as much as possible. Its results have not been so brilliant as was anticipated. The procedure will probably be followed by stiffness, and the likelihood of cure is not so great as if a formal resection is done. It is most applicable in children of an age unsuitable for resection. In them accompanied by a free use of the curette for the removal of disease foci in the bones it is the operation of choice. As one approaches adult age so does its desirability lessen.

A new method of resection of the elbow-joints which is very convenient and effectual as compared with other operations now in general use. An incision is made through the skin and subcutaneous tissue, beginning at the outer side of the biceps tendon 2 centimetres under the epicondyle and extending obliquely outward parallel with the interarticular line; it then runs obliquely over bone upward along the inner border of the ulna, ending beside the olecranon. The flap is dissected upward by separating in the region between the anconeus and the epicondyle. The periosteum of the ulna and the triceps tendon are separated from the bone together. Then follows the opening of the joint dislocation and resection in the usual manner. Tito Cavazzani (Phila. Med. Jour., from *Centralb. f. Chir.*, Oct. 21, '99).

In cases which are aseptic at the time of operation the manipulations, as far as possible, should be carried out with instruments, so that the finger or hand does not come in contact with the inside of the joint. Also in those joints which are still free from the invasion of microorganisms asepsis should be practiced rather than antiseptics, and all irritating disinfectants should be vigorously

avoided. In joints already invaded by bacteria the old-time method of draining with tubes should be discarded and free incisions with wide opening of the joint should be done so soon as the presence of pus is detected. König (*Archiv f. klin. Chir.*, B. 61, H. 3, 1900).

TREATMENT OF CHRONIC CASES.—Arthritis not infrequently pursues an extremely chronic course. Its treatment is to be varied according to the diathesis present. Thus syphilis or rheumatism or other constitutional affection should receive the constitutional remedies appropriate to them in addition to the local treatment. Many arthritic cases are kept in a chronic condition by the inability or indisposition of the patient to keep the joint sufficiently long at rest for a cure to be effected. I have frequently seen joints improve after other methods had been tried when absolute rest in bed was enjoined. This rest should be insisted on until all evidences of activity of the disease have ceased. The joints of the lower extremities are the ones most often affected, but those of the upper are likewise attacked. When the wrist is involved the hand and forearm up to the elbow may be enveloped in a plaster-of-Paris or preferably a silicate-of-soda bandage. Another convenient way of fixing the wrist is by means of leather. A piece of harness or not too heavy sole-leather is obtained, and two pieces cut of a size suitable to reach from near the elbow to the metacarpo-phalangeal joint and each half way around the arm. They are then to be soaked in warm—not hot—water and applied to the arm; with a penknife a space is cut for the thumb and the splints shaped to fit the hand and forearm. The edges may be shaved thin so as to allow of overlapping. With a bandage the two pieces of leather are fastened firmly on and allowed to remain until the next day. They will then be

found to be hard when they can be removed, lined by pasting chamois-skin on the inside and the two splints fitted either with straps or eyelid holes for lacing. Over the affected joint a piece of lint spread with belladonna and mercury or ichthyol ointment may be spread or it may be painted with iodine or treated in any way desired. The use of the local hot-air baths is very desirable in arthritis arising from traumatic or rheumatic causes, but not in tubercular ones. This is likewise true of electricity and massage. These hot-air baths should be carefully watched to see if their effect is suitable to the particular case, for not infrequently they aggravate instead of alleviate the trouble.

For stiff and sprained joints, the limb with the affected joint is placed in an appropriate box and the temperature gradually and yet rapidly raised from 240° F. to 280° F., and even, in some cases, to 300° F. This temperature is maintained from half an hour to an hour. The treatment is not uncomfortable, although the skin becomes very red and moist. The results are very satisfactory, some of them being almost marvelous. Alfred Willett (*Clin. Jour.*, May 30, '94).

Hot air is almost always followed by good results; but in one case there was much inflammation about the joints and success did not attend the treatment. Alice M. Seabrooke (*Phila. Polyclinic*, July 30, '98).

Very good results following applications of hot air for about an hour, the temperature being brought up to about 250°, and in some cases to 300°. The structures about the joints are much softened by such treatment, and yield to forced stretching. J. T. Rugh (*Phila. Polyclinic*, July 30, '98).

When any one of the three large joints of the upper extremity is affected the hand should be carried in a sling.

When the elbow or shoulder is to be treated the silicate of soda probably makes the best splint-material. It would

be far more popular than it is if the method of its use were better understood. The secret of success is in first having the bandages thoroughly impregnated with the silicate, and, secondly, in not applying too much silicate while making the splint.

If gauze or scrim or crinoline is used, then it is easy enough to have it thoroughly soaked with silicate, but with cotton bandages a certain amount of silicate should be placed in a basin and the bandage allowed to pass through it as it is wound by hand. A convenient machine for the preparation of these bandages is one I have been using for years. It consists of a V-shaped box into which the silicate is poured. The bandage goes over the edge of the box down under a rod at the bottom and up to be wound around a small handle, or winch. In applying these bandages the part is first covered in the same manner as for plaster-of-Paris. All surplus silicate is squeezed from a bandage, and it is then applied. After a couple of layers, strips of tin are laid on and covered by a couple more layers of bandage. These tin strips should always be used in dressings of any size, as they prevent the bandage's becoming wrinkled, and keeps it in shape until properly hardened, and also adds somewhat to the strength of the apparatus. Additional silicate is *not* to be smeared on over the various layers of bandage. The hand should be moistened with warm water and the bandage smoothed therewith. Made in this manner, the bandage will take about twenty-four hours to dry, and will get as hard as a stone and yet be extremely light.

It may be made removable by cutting down with a knife and inserting hooks or eyelets. If hooks are desired, the large size may be bought at any dry-goods-store and these sewed to the folded

edge of a strip of unbleached muslin. This is then pasted along the cut edges of the bandage with additional silicate and left for another twenty-four hours to dry. The bandage if applied for disease of the elbow should be carried well up toward the shoulder and down toward the wrist. If this is not done too much motion is allowed at the joint. When the shoulder is affected the arm is to be confined by the dressing to the body to prevent its swinging. In the treatment of chronic joint diseases orthopaedic apparatus can often be used to advantage. Thus in disease of the elbow-joint a useful form is composed of two side-irons with a joint opposite the elbow, which is capable of being so regulated as to allow a little or no motion as is desired. The two side-irons are fastened to the arm by two leather sockets, one lacing around the arm above the elbow and the other below the elbow.

Affections of the hip-joint are usually treated by adhesive-plaster extension, from five to fifteen pounds being used; the limb is steadied either by sand-bags on each side or by means of a long, lateral splint.

In walking cases some form of the old Davis or Taylor traction splint may be used. The same object is accomplished by the patient's wearing a high shoe on the healthy limb and using crutches. The affected limb is allowed to hang. To steady it a plaster-of-Paris or silicate-of-soda or other dressing is applied around the pelvis and thigh, down to the knee. The long posterior splint of Thomas is also of service. For the knee one may use an elastic knee-cap or a light plaster-of-Paris splint, or one made of leather, or silicate-of-soda or even pasteboard is suitable. Of whatever material the splint is made, it should go high up toward the hip and low down

toward the ankle, otherwise too much motion will be allowed. Thomas has also devised a serviceable apparatus to be used in these cases. It is composed of two side-irons in the form of the letter U. The two upper ends are joined by a padded iron ring and the opposite extremity projects beyond the foot. The patient puts the leg through the ring and practically sits down on it, allowing the leg to hang between the side-irons. A bandage confines the apparatus to the limb. Other forms of apparatus are also of service. Thus, one can be made with two side-irons which are jointed opposite the knee-joint. At least one of these side-irons goes down to the foot and is fastened to a steel sole-plate. If this is not done, it will be found almost impossible to keep the apparatus from sliding down. The amount of motion to be allowed is regulated by altering certain stops at the knee-joint. Many of these knee cases can be allowed a certain amount of motion with benefit, because it is only when the motion is excessive or takes place in some unusual direction—as twisting—that it is harmful.

For the ankle, silicate-of-soda, plaster-of-Paris, or leather supports are needed. In light cases the elastic-webbing bandage or Martin's rubber bandage gives considerable support. If it is desired to keep the joint quiet, then the dressing should extend well out toward the toes and well up toward the knee. For more permanent use a steel sole-plate may be inserted in the shoe, and from it two side-irons go up the leg. There need be no ankle-joint, as the patient can walk quite well, even with the ankle stiff. An apparatus can be constructed on somewhat similar lines to go inside the shoe, and thus can be worn with different shoes.

Rheumatic Arthritis.

Rheumatic affections of the joints do, at times, claim the attention of surgeons. Rheumatism in an acute form comes under the care of the physician, but not seldom it assumes a chronic form and becomes localized in a joint and produces such disability as to require special local treatment, and then the surgeon is called upon. It is a strange fact, although one perfectly well known, that an injured part is more liable to become affected with rheumatism than one previously healthy. Patients who have suffered comparatively little, except slight pains in various parts of the body, may, after the reception of an injury, have a distinct rheumatic inflammation, in a subacute or chronic form, affecting the injured part. Any physician who sees general injuries or affections of the joints is certain to be called upon to treat cases in which the rheumatic element plays a more or less conspicuous rôle. The disease in an early stage may be only a synovitis, with serous or sero-fibrinous effusion into the joint; if, however, the attack is exceptionally severe, especially in duration, the whole articulation becomes involved. The sero-fibrinous effusion may be abundant and not confined to the joint, but involve the capsule, ligaments, and periosteum, and even extend some distance into the surrounding structures. The cartilage also suffers, and it becomes roughened and may even be worn off, leaving, in places, the bone exposed. The effusion may be of a plastic character that will bind and mat the various structures of the joint and its neighborhood together, thus producing a fibrous ankylosis. Calcareous salts may be deposited in this exudate, producing an exostosis, which causes a bony ankylosis. The periosteum engages actively in this process. It is probable

that many cases of arthritis which are regarded as being purely of a traumatic character owe their obstinate course to a rheumatic taint.

A number of English authorities on this class of diseases are now agreed that under the name rheumatic arthritis at least two and possibly three diseases, distinct from one another, exist. One authority expresses the opinion that three perfectly distinct joint affections exist under this name. First, the pathological condition commonly confined to the hip-joint, seen but rarely except in elderly people, designated as senile osteoarthritis, and more frequently seen in men. The second form is an affection met more frequently among women about middle life, usually beginning by bony enlargements in the terminal joints of the fingers and in the carpo-metacarpal joint of the thumb. Third, a form which occurs most in women who are seldom much over twenty years of age, the first symptoms noticed being a tumefaction of the proximal phalangeal joint. The swelling often becomes early noticeable in the wrist. Its characteristics are its acuteness, its distinctly symmetrical character, and the fact that the swelling extends well beyond the affected joints, so that the fingers take on a fusiform appearance.

In the first form, the senile hip-joint has been generally recognized by medical men as a more or less distinct pathological entity for some time. The second form beginning in the terminal finger-joints is quite frequent, and is often considered of little significance. There are no serious symptoms possibly for many years, but the deformity may eventually become marked. The bony outgrowth so characteristic of the disease involves many joints and the patient becomes a helpless cripple. The symptoms, however, are never acute, and there is never any temperature. In the third form of the disease the symptoms are very acute, beginning with pain, swelling, and redness, the temperature ranging from 100° to 102° F. This febrile condition continues for three or four weeks, when the self-limitation

which suggests the infectious nature of the ailment disappears, though the pulse does not become normal for a longer period. Marked immobility and muscular atrophy remain. After the attack recurrences are the rule, and each attack leaves the patient a little worse off than before. Dr. Garrod gives it as his opinion that the only way to make our knowledge of these varieties of diseases definite is to admit the existence of these three forms and look for the result of autopsies to confirm the clinical distinction. Editorial (Jour. Amer. Med. Assoc., Feb. 14, 1903).

In a fatal case of arthritis, endocarditis, and chorea a streptococcus was isolated from the blood before death. This organism did not differ materially from the common varieties of streptococcus pyogenes in cultural properties, but produced very characteristic lesions in rabbits when injected intravenously. Such inoculations were always followed after a few days' incubation period by a multiple arthritis which usually started in the ankles. In one rabbit extensive vegetations were found on the mitral valve, while typical infarctions were seen in the spleen and kidney. The writers believe that this streptococcus is the same as that described by Wassermann, Meyer, Poynton and Paine, and Walker, and considered at least by the last three observers to be the specific cause of rheumatic fever. M. J. Lewis and W. T. Longcope (Annals of Surg. Amer. Jour. Med. Sci., Oct., 1904).

Symptoms.—The main difference between the symptoms of a rheumatic and simple arthritis is that those of the former are far more painful both to the touch and also to movements. Not infrequently the signs of inflammation run high, and then the joint looks red. When, however, the course is more sub-acute or chronic it possesses a dead, milk-white look that is highly characteristic. Even when of this color the sensitiveness may be as acute as ever. Movements cause great pain, and in long-standing cases they are much restricted. Swell-

ing is present, and joints are apt to assume a more fusiform shape than is the case in a simple arthritis. Edema may also be present. Certain portions of the joint may be more affected than others. Thus I have seen the knee swelled at the side and above the patella and the shoulder at its anterior part. In some of these cases the adjoining bursæ may also be affected.

Treatment.—In addition to the measures generally used for simple arthritis those appropriate for the rheumatic diathesis must also be employed. (See RHEUMATISM, volume v.)

It is important to bear in mind that the joint is to be protected from disturbing movements. It is here that rheumatic differs from simple traumatic disease of the joints. In the latter a small amount of movement may not be painful, but in the former the opposite is the case. Massage is not apt to be of service except in chronic cases, certainly not in acute ones. Rest on a splint is to be enforced, with the joint wrapped up in cotton or flannel. The application of cloths wrung out of hot alkaline solutions may be tried. A piece of lint wet with chloroform liniment and covered with woolen cloths may give relief. Osler advises the use of the Paquelin cautery, lightly and rapidly stroked over the part, as a means of reducing pain. The use of leeches is not so efficacious as in traumatic cases. Cold applications are only to be advised when not distressing to the patient. The use of hot-air baths must be decided by a cautious trial. The heat at first should not be great, and in many cases, particularly acute or subacute ones, local hot-air baths are not to be used at all.

General hot-air baths and also Turkish baths are far more apt to be of service in all cases.

In treatment of arthritis by hot-air baths the patient lies in bed. The tent which covers him is made of two large cradles, covered first with blankets, then with mackintosh sheets, and then again with blankets. The coverings must be arranged at the top of the tent in such a manner that a small opening can be made to let out the hot air when it has become saturated with moisture. If the packing be too tight, a counter-opening must be made. The patient's neck should be wrapped as air-tight as possible. The cradles used are made of wire netting on a metal frame. The flue attached to the lamp passes through an opening in the blankets at the foot of the tent, and may be covered with asbestos or a wet cloth to protect the blanket. The lamp should be made without solder. The blanket which has covered the body is removed finally to allow of free evaporation from the surface of the skin. The patient is wiped down after the bath, and wrapped in dry blankets for the rest of the day.

As a rule, an opening need not be made till the patient breaks out in a good perspiration or complains of feeling too hot. The opening should be made at the top of the tent. This is the important point in the treatment.

This treatment is applicable to:—

1. Subacute rheumatic arthritis.
2. Subacute arthritis following acute rheumatism, or rheumatoid arthritis, associated with pain and stiffness on movement, with continual aching pains.
3. Impaired mobility following injuries to joints or to muscles in their neighborhood, and cases of joint-trouble from trophic causes or disuse. T. Sydney Short (Brit. Med. Jour., Nov. 26, '98).

Too vigorous local treatment is very apt to relight the trouble; coaxing, and not forcing, is our motto. This is true also of passive motion. What is gained by gentle persistent motion is apt to be retained, but what is acquired by forcible movements under anæsthesia is apt to be lost and the joint remain stiffer than before. Notwithstanding the assertion of Treves ("System of Surgery," volume

i, page 267), that rheumatism and gout have practically no effect on the immediate future of an operation, care should be exercised. In disabilities resulting from loss of motion in joints partial operations are liable to be extremely unsatisfactory, and only start the trouble anew, as I have seen, and the total removal is more satisfactory. Thus, in the elbow-joint a formal incision is apt to give a better result than the removal of exostoses. In one case I deliberately excised the joint of the big toe for an intractable rheumatic inflammation that had lasted over a year, resulting in partial disorganizing of the joint. While it is possible that rheumatism may, at times, have a septic element in it, the practice of tapping and washing the joint with a mild antiseptic solution is only to be followed with caution and in selected cases.

Heroic treatment of acute rheumatism by means of opening and draining the affected joints advocated. Operation should be performed as soon as one joint is definitely affected, in order to save other joints and the endocardium. General toxæmia disappears when the affected joints are irrigated and drained. The incision into the joint must be large enough to admit the index-finger in order to remove the coagulated lymph. Irrigation with 1 in 5000 solution of binioidide of mercury and potassium is best. The joints should be dried with a long roll of gauze in order in drying to remove all flocculi. The joint should be drained by a gauze drain. J. O'Connor (Annals of Surg., Feb., '98).

Report of 22 cases of rheumatic and allied diseases of joints complicated by deformity. Personal experience has shown that the hot-air treatment in multiple arthritis with deformity is disappointing. There is usually a temporary relief, but relapses occur. While it is difficult to fix upon any one form of treatment, the forcible breaking up of adhesions when inflammatory conditions have subsided and the discriminate use

of plaster of Paris have yielded the best results. Each year the efficiency of absolute immobilization as a promoter of absorption of chronic inflammatory products has affirmed itself. The protection of joints with a limited range of motion by apparatus within the bounds of this motion is also recommended. V. P. Gibney (Med. Record, Mar. 2, 1901).

Gout, Arthritis of.

Gout is certainly less common in this country than abroad. On this account it may not be recognized at first sight. It attacks all the joints, but most frequently the metacarpo-phalangeal joint of the big toe. It may present itself in an acute form, affecting only one joint, or in a more chronic form. This latter is usually preceded by the former. So that the chronic form of the disease may be largely the remains of several acute attacks. The changes produced in the parts are marked, as is also at times the resultant disability. The cartilages are apt to be first attacked and then the surrounding structures. Urate of soda is deposited in the joint on the articular cartilages and through them, in the capsular ligaments, and even surrounding tissues. To such an extent is this latter the case that gouty nodules of urate of soda deposited on the knuckles not infrequently ulcerate through the skin.

Statistics of the location of the pain in cases of gout and rheumatism occurring in Roosevelt Hospital.

In all diarthritic joints the painful points in gouty inflammation were, with certain specific exceptions, on the condyles. In acute rheumatic arthritis, on the other hand, the pain was more diffused, but distinctly pronounced along the tendons, and at their attachments, but not on the condyles. In rheumatoid arthritis there was no uniformity in the localization or tenderness on pressure. In gout the periosteum was chiefly affected, and in rheumatism the substance of the bone. W. H. Thomson (Amer. Medico-Surg. Bull., Aug. 16, '96).

The treatment of an acute attack is to be sedative, but not too depleting. This subject is fully treated under GOUT, volume iii. Surgical measures are rarely required. When the chalky deposits are marked, and, if they are loose, the skin may be incised and the deposit turned out. Care should be taken not to injure the skin over these deposits or it may ulcerate and leave an exceedingly annoying sinus.

Charcot's Disease.

This name is applied to the joint-affections which at times accompany locomotor ataxia. Charcot estimated that they occurred in 10 per cent. of the cases of ataxia, but in this country, at any rate, the proportion is much smaller. The changes produced in the joint resemble to a considerable extent those present in osteoarthritis. The course of the affection, however, is different. There are the same cartilaginous changes, with first fibrillation and then disappearance. There is a marked increase of synovial fluid, bulging out the joint usually more marked than in osteoarthritis, and there are the same ridges of bone, with occasional nodules. The disorganization of the joint is apt to be more rapid and more marked. Whereas a joint affected with osteoarthritis tends to ankylose, that affected with Charcot's disease becomes loose and flail-like. Pain is a marked symptom in the former: In the latter it is only present to any extent in the early stages, to be replaced later by anæsthesia. Even the bones wear away as if from pressure. It usually attacks single joints, but both knees may be affected or the elbow and fingers. At times its course is rapid disorganization occurring in a few weeks, and this independently of the fact of use of the joints. These cases are of particular in-

terest to the surgeon, because he is liable to be consulted before the ataxic disease has been recognized, and their true character is liable to be overlooked. Whenever an adult patient comes with a joint largely distended with fluid, with comparatively slight pain, and with symptoms apparently too mild for the evident destructive lesions present, then one should search for ataxic symptoms.

Possibility of the occurrence of marked joint-lesions before the symptoms of spinal disease manifest themselves to any great extent. Attention called to the close similarity between the joint-lesions of tabes dorsalis and those of syringomyelia; but, while the former disease affects the lower extremities (76 per cent.), the latter confines itself to the upper. Osteomata of the tendons, muscles, etc., are found in both diseases, but more frequently in syringomyelia. If only the local conditions were considered, it would be difficult to differentiate the two affections. The joint-lesions may be divided into the atrophic form, which is rare, and the hypertrophic form, which is more common. Charcot (*Le Prog. Méd.*, Apr. 29, '93).

Locomotor ataxia manifests itself by inco-ordination of movements, want of ability to balance one's self, especially with the eyes closed, by shooting pains in the lower extremities, also gastric disturbances. The pupils do not react to light, but do to accommodation,—the Argyll-Robertson pupil. The reflexes become lost, there may be ptosis or strabismus, or even a commencing optic atrophy, and as the disease advances paraplegia with loss of control of the sphincters. (See LOCOMOTOR ATAXIA.)

Treatment.—The disease is practically incurable. When it seems very active complete rest may be enjoined, but when it is slow, then supports may be applied to the joints so that they can be used as long as possible. It is in the highest degree advisable not to subject these joints

to operative procedures. It is a great temptation to recommend the removal of a limb whose knee-joint is absolutely disorganized; but doing so may result in the death of the patient, because the attempt at healing may be slight or totally lacking.

Conservative and palliative treatment is to be advised and the joint given all the support possible. Of course, the treatment proper for ataxia is to be given, as well as local attention to the affected joint.

Septic Arthritis.

The joints frequently are attacked by an inflammation of a septic character while there co-exists a septic disease affecting the body generally. This infection is caused by a pus-producing organism, the staphylococcus. Pyæmia, typhoid and other fevers, and the puerperal state are the diseases most often accompanied by septic joint-affections.

Inasmuch as the condition is much the same in all, they present, to a great extent, similar symptoms. The joint becomes the seat of an effusion, usually with pain. Sometimes only one joint is affected. When such is the case it is apt to be a large one, as the knee or hip. This is frequently the case in puerperal, typhoid, and other fevers. In pyæmia several joints are apt to be attacked. The onset is liable to be very insidious and may be passed unnoticed, being masked by the symptoms of the general affection. The pain in the joint may produce a restlessness which may be attributed to nervous or other disturbance; so that the disease may be far advanced when recognized. Sometimes the local disease progresses with great rapidity, pus being present in the joint almost from the first.

A personal study of 52 published and personal cases of arthritis due to the

pneumococcus suggests nearly all of the conclusions reached by Leroux, some of which are here practically repeated: It is a rare affection, found oftener in men, sparing no age. It appears oftenest during or shortly after croupous pneumonia, sometimes as late as the third week after the crisis.

It may be primary in the joint, and severe and even fatal constitutional symptoms may result from the toxæmia thus induced; in these cases of primary pneumococcic arthritis pulmonary localization may or may not occur.

Previous damage to a joint as by trauma, rheumatism, or gout favors the localization. The lesions may be limited to the synovia or may be more extensive, involving the cartilages and bones. The periarticular structures may be involved. The subacute cases are sometimes highly destructive to the joint, and the same is true of some of the more acute ones. The lesions are usually monarticular (61.5 per cent.), larger joints being oftenest involved. The knee is the joint most frequently affected. The joints of the upper extremity are affected a little oftener than those of the lower, but the difference is insignificant. The condition is recognized by the ordinary signs of an acute or chronic inflammation of a joint. Exploratory aspiration, with bacteriological examination of the fluid, is the only means of recognizing the pneumococcic nature of the inflammation. The gonorrhœal arthritis and peri-arthritis have to be carefully excluded, as well as the arthralgias following pneumonia.

The prognosis is grave,—mortality, 65 per cent.,—largely because of the accompanying bacteræmia and involvement of other more vital parts of the body (meninges, pleura, pericardium, etc.). Yet spontaneous recovery occasionally follows, even where there is a purulent exudate. The cases of suppurative pneumococcic arthritis should be treated by immediate incision and drainage. Serous arthritis may often be healed by aspiration, rest, and compression. J. B. Herrick (Amer. Jour. Med. Sci., July, 1902).

The joint swells and effusion is usually easily diagnosed. On the contrary, the first symptom may be pain. Pain is a very constant symptom of general sepsis and pains in various parts of the body may be complained of before any definite joint disease is visible. The color of the skin over the joint is not apt to be changed at first; but, if disorganization of the joint takes place, then it may become red and oedematous. In the hip-joint, which is exceedingly liable to become affected in typhoid fever, dislocation is very apt to occur. If the hip trouble occurs early in the course of the general disease, it may, as in one case in my own experience, be difficult to diagnose the condition from acute hip disease of a tubercular character. Multiplicity of lesions always argues for a general infection; therefore, when more than one joint is affected, one is almost sure that the disease is only a local manifestation of a general condition instead of being a distinct and separate local disease. Oftentimes if the general disease tends to recovery the local joint trouble may be more of the nature of a synovitis than an arthritis, and may pursue a mild course, particularly if only a single joint is affected. If, however, the general disease is grave the local disease is of a purulent character almost from the start, and suppuration may persist a long time, until death finally ends all.

Treatment.—At the onset of the joint trouble measures should be taken to soothe the irritation of the joint and protect it. It may be surrounded with cotton, or lint wet with lead water, and supported by leather or pasteboard splints. Sand-bags may also be placed on either side and an ice-cap laid on the joint. Sometimes enveloping the part in hot cloths is most comfortable. A conservative course should be pursued as long as

the disease is not progressing too fast. If it assumes a chronic form the joint may be wrapped in lint spread with belladonna and mercury ointment or one of 10- to 20-per-cent. ichthyol, and supported by a firm bandage and splints. If, however, the joint-symptoms become very active, it should be aspirated and washed out with sterile salt solution or boric acid or weak bichloride solution.

If suppuration becomes marked, free incision with drainage may be necessary.

In these cases free stimulation to support the general strength is of the greatest importance, because they are liable to last quite a long while and eventually kill the patient by gradual exhaustion.

The writer divides the acute purulent inflammations of the knee-joint into three groups: 1. Metastatic or pyæmic suppurations. 2. Suppurations due to osteomyelitis. 3. Traumatic suppurations. Diagnosis of pus in the knee-joint should present no difficulties. If, however, there should any doubt as to the presence of pus, the aspirating needle must be resorted to at once. The treatment will depend, to a great extent, on the origin of the infection.

1. *Metastatic or pyæmic suppuration.*—Ordinarily the onset of this trouble is mild, its course inclined to be chronic. The local symptoms are not very salient and are often obliterated by those of the general condition, so that they may be overlooked both by patient and physician. Occasionally, however, they will be very acute and obtrusive. The mildest infantile forms show even a tendency to spontaneous cure, and ought not to be meddled with. If the local symptoms are troublesome they will demand surgical intervention. First evacuation by puncture, and if the collection be ropy and thick irrigation must be resorted to. Rapid reaccumulation will demand incision and drainage.

2. *Suppuration due to osteomyelitis.*—Osteomyelitis is eminently a disease of adolescence, being most frequent in the

years just preceding puberty. In the lower extremity the place of predilection is the neighborhood of the knee-joint, or more precisely, the lower epiphysial line of the femur, or the upper one of the tibia. In every case of osteomyelitis attacking the tibia or femur near the knee, it is the duty of the physician to watch the joint and not overlook an effusion distending it. According to present ideas every osteomyelitic focus should be freely opened as soon as the diagnosis is made. If this were always done early extension to the articular cartilages could at times be avoided. When the knee-joint is once involved the route of the infection must be found and excised and arthrotomy performed. In cases of virulent infection this may not be sufficient. In such cases Mayo's method of opening the joint will give, usually, good results. It consists of the transverse incision of the infected knee-joint, passing from condyle to condyle just above the patella, and, of course, dividing the quadriceps tendon. Ollier, the French surgeon, supplemented Mayo's incision by advising the extirpation of the crucial ligaments. The leg if necessary may be sharply flexed at the knee, which will permit packing the joint cavity with gauze.

3. *Traumatic suppuration.*—These cases of knee-joint infection are, as a rule, the most dangerous. They ordinarily call for the radical operation (Mayo's) and not infrequently amputation will have to be resorted to. This latter measure must not be postponed too long, when needed, as the patient will otherwise perish. The experience gained during the Spanish and Transvaal wars would seem to indicate that gunshot wounds of the knee are usually sterile, and may be treated conservatively. Up to and including the Franco-Prussian war attempts to save the leg by conservative surgery, when the knee-joint was involved, gave a mortality at times as high as 100 per cent. Whether the experience of civil life at the present time gives similar results to those obtained in the recent wars the author is

unable to say. Gerster (Medical News, Sept. 19, 1903).

Syphilitic Arthritis.

Syphilis attacks the joints the same as it does other tissues. It may occur in infancy, from heredity, in the secondary stage, or in the tertiary. In infancy, as well as to a somewhat less extent in adults, the disease is to be diagnosed and recognized not so much by its own peculiarities as by its surroundings and associations. If there is any point that may be more noticeable in it than in other affections of the joint, it is its less acute and less painful course. In infancy the joint, particularly the knee, may become swelled and somewhat—but not exceedingly—painful, nor very red, but be held stiff, and accompanied by atrophy of the muscles. There is usually present other manifestations of the disease, such as skin eruptions, eye affections, notched or pegged teeth, etc. A syphilitic history may also often be traced in the parents. As I have seen it in infancy it assumes mostly the synovial type and yields to specific treatment. The disease also attacks the joints in the secondary stage. It then shows itself as an effusion into the joints, resembling very much rheumatism, but not in a highly-acute form. One's attention to its true character will probably be attracted by the other secondary symptoms. The disease of the joint will assume a mild acute or a subacute form. In the tertiary stage of syphilis the joint disease is manifested by a deposit of gummatous tissue in the various parts of the joint. The swelling may be more irregular than in rheumatic disease, from the deposit's occurring in some portions of the joint while other portions are free. As a rule, it does not occasion suppuration, although ankylosis may occur. This may be fibrous or even bony.

The main symptoms of syphilitic arthritis are exacerbating nocturnal pains, with fever of a remittent type. The most certain signs are the demonstration of gummata in the capsule of the joint, together with a thickening of the capsule, effusion into the joint, and a "cracking" sound when the joint is moved. Cipriani (*Deut. med.-Zeit.*, Sept. 24, 1900).

Gonorrhœal arthritis is a joint infection due to a specific micro-organism or the toxic products of the same, transmitted through the blood to an articulation susceptible to infection either from previous traumatism or an inherent lack of resistance. The term gonorrhœal rheumatism is a misnomer, both as regards diagnosis and treatment, and should be totally abandoned. Antirheumatic remedies, although they may relieve pain, will not kill the infecting organism, and are useless. A joint infection may take place either coincidentally with or several weeks after the apparent cure of the specific urethritis. If the joint is tapped early, the diplococcus will be found to be present; later, it may have died. The diagnosis depends largely upon microscopical examination and the laboratory culture. The only rational treatment is the prompt removal of the infecting micro-organism by arthrotomy and free irrigation with antibacillary fluids. De Forest Willard (*Therap. Monthly*, July, 1902).

Treatment.—If the true nature of the disease is recognized, antisyphilitic measures are to be employed. In infancy mercurial inunctions are best. In adults inunctions are desirable if it can be made convenient to use them,—if not, then internal medication. The biniodide of mercury beginning with about $\frac{1}{24}$ grain and rapidly increasing to a quarter or more three times daily is my preference. The green iodide of mercury $\frac{1}{4}$ grain three times daily or a mixture of bichloride of mercury and iodide of potassium or sodium in compound syrup of sarsaparilla are also favorite forms of medica-

tion. In doubtful cases iodide of potassium or sodium should be given, as it is likely to be of benefit whether the case is one of syphilitic or rheumatic origin. Locally the methods used for other forms of arthritis are to be used, but the joint may be covered with lint spread with belladonna and mercury ointment.

Tubercular Arthritis. (See also HIP-JOINT DISEASE, volume iii.)

Tubercular arthritis is the name given to what was formerly known as scrofulous or strumous disease of the joints. When the knee-joint was affected, it was called tumor albus; it has also been called gelatinous arthritis. It is now positively known that the characteristics of this disease are due to the tubercle bacillus, and that in its pathology it is a true tuberculosis affecting the bones and joints. The tubercular process is a local one; it may and often does occur in company with other tuberculous manifestations elsewhere, but it is late in the course of the disease. The tubercle bacillus becomes disseminated and starts up tubercular processes elsewhere.

In the commencement, the joint, or the adjacent bone, alone is affected. The part becomes infiltrated with small cells, giant cells form; caseation, pus, and necrosis forms; and the bones become destroyed and the joint disorganized. The origin of the disease process is of the greatest importance. Cases occur which look clinically as if the joint alone was involved; as if it was the seat of a tubercular synovitis and that alone. In other cases it is evident that disease of the bone is present, as well as of the synovial membrane. Almost all surgical authors describe these two forms of joint-tuberculosis. Most of them regard the osseous form as being the more frequent, but also that the synovial form is very common.

The early recognition of tubercular lesions of the joints is of great importance. It is a great mistake to suppose that joint pains in children are due to rheumatism. Another prevalent error is that only the children of tubercular parents are liable to develop tuberculous lesions of the joints. In making a diagnosis in the early stages, the most significant symptom, and the one which should make the physician suspicious and cause him to put the part absolutely at rest, is muscular rigidity. Pain, tenderness, and inflammation may be entirely absent in these cases in the beginning, and therefore are not at all necessary to a proper diagnosis. De Forest Willard (*Jour. Amer. Med. Assoc.*, Apr. 13, 1901).

Recently Edward H. Nichols, of Boston, read before the American Orthopædic Association an elaborate paper on joint-tuberculoses, and he states as his opinion that primary synovial tuberculosis is exceedingly uncommon, and that of 120 tubercular joints he has not seen one in which on sawing open all the bones in thin layers one or more old bone foci were not found. I am inclined to believe that he is right in his opinion and that those joints which have been examined and pronounced to be synovial tuberculosis would have showed in most cases to have bony involvement if the bone had been examined in a number of thin sections. Whatever the true pathology of tubercular joint diseases is, they certainly manifest themselves clinically in the two forms.

Symptoms.—Joint-tuberculosis, while essentially a chronic affection, still sometimes runs an acute course. When it does so, it may exhibit all the signs of inflammation,—viz.: heat, redness, swelling, pain, and disturbance of function. Commonly, however, the disease begins insidiously. Disturbance of function is apt to be the first symptom, particularly if the hip or knee is affected. The skin

ordinarily remains white, the joint becomes swelled, due to the swelling of the synovial membrane and increase of fluid. Pain begins gradually, and, while sometimes almost entirely absent, at others is felt only on use of the joint. Redness occurs when pus has formed and is working its way toward the surface. This occurs usually at certain definite spots which break down and form sinuses which lead down to carious bone and in cases of long standing directly into the joint. The pain is felt in the joint itself, in the epiphyseal ends of the bones, and in certain cases in distant parts as the pain along the inner side of the knee in hip disease. As the disease progresses the joint becomes disorganized, pieces of bone exfoliate, sequestra are formed, the general health deteriorates, and in a certain number general tuberculosis ensues and causes death.

Almost any joint can become affected, but the most commonly attacked are the spine, hip, knee, ankle, elbow, and wrist. The small bones and joints of the foot and hand are also not seldom involved.

In tubercular joint disease an early diagnosis is essential if the case is to be cured with a return of function. Pain and stiffness are two important symptoms. Pain is rarely located in a certain spot, but in indicating it the hand is usually passed over a certain region. It is worse on motion, and is apt to come in paroxysms at night, when the muscles holding the joints quiet are relaxed. Stripping the patient is of the utmost importance. The history is important. That of 453 cases studied was negative in 309, in 76 heredity was not mentioned, but in 68 a positive tubercular family history was obtained. L. W. Ely (*Med. Record*, Dec. 16, '99).

Experiments to ascertain the value of the tuberculin test in tuberculosis of the bones and joints. Seventy-eight per cent. of those who recovered, 100 per cent. of the "quiescent," and 80 per cent. of the active responded in a positive

manner. Those cases in which for periods varying from one to seven years there had been no clinical evidence of active tuberculosis reacted with the same relative frequency as those in which there was every reason to believe the tuberculous process was active.

This high percentage of positive reactions in apparently healthy individuals probably attributable to remnants of the disease, such as small islets of tissue, microscopical in size perhaps, wholly encapsulated, in which were imbedded the bacilli of tuberculosis in a dormant state, especially about a joint which had for years been the seat of the disease. Frazier and Biggs (Univ. of Penna. Med. Bull., Mar., 1901).

Treatment.—Tubercular disease of the bones and joints is not so serious a disease as is that of the lungs. The patients usually recover; but are left in a more or less crippled condition according to the severity of the affection. As so many patients preserve a fair state of general health, while possessing a diseased joint, the local treatment becomes more important than the constitutional. In other words, the best way to improve the general health is to better the joint affection. Attempts to "build up the system" while neglecting the local trouble will only end in disaster. The main element of local treatment is rest. Tubercular attacks often follow injuries. Not only is this so, but the disease is kept active by repeated, slight irritations due to movements and use of the part. Therefore protection is required. The more acute and marked the trouble the more absolute must the rest be. It is practically impossible to secure this when the spine or knee or hip are affected unless the patient is placed in bed. Parents, and even physicians sometimes, think that prolonged rest in bed will be injurious to the general health, but experience has abundantly proved that this is not so, and whenever it is possible to do so the

patient should be put abed and kept on his back until all symptoms of activity of the disease have subsided. This should be done for months or even a year or two if necessary. In order to keep small children in bed and to prevent their sitting up, it is desirable to fasten them down by means of a towel passed across the chest and pinned fast with safety pins to the mattress. Bradford devised a frame of iron gas-pipe to surround the child and covered with canvas or unbleached muslin. The child may be fastened to this by means of a sort of apron passing across the chest with straps passing over the shoulders. This is useful in affections of the hip as well as of the spine. Extension is of service in diseases of the hip and knee; its object is to keep the joint-surfaces from being pressed together by muscular contraction. Its good effect is at once seen by the diminution of pain. It allays muscular spasm. Even when the patient is allowed to go about, the same object is aimed at by the use of a suitable apparatus.

Mechanical supports or splints of some kind are of the greatest service. Plaster of Paris and silicate of soda are of great utility. Also splints made of pasteboard or wood or leather. When quick setting is required or frequent changing then plaster of Paris is best. When the patient can remain in bed for twenty-four hours and where quick setting is not required and the apparatus is to be worn for a considerable time then silicate of soda is preferable. For the upper extremity splints of wood, or pasteboard or leather are applicable; but these various dressings can be used in any part of the body and the choice will depend on the peculiarities of the individual case and the mechanical abilities of the surgeon. These dressings should all be so made as

to be removed every day or two, so that the parts can be inspected and bathed and excoriations prevented. In spinal disease when the patient is not fastened down in bed, then it is desirable that the apparatus be worn during the night as well as by day; it insures better rest to the diseased part. Local applications do not play a very important part in treatment. In acute cases evaporating lotions like lead-water may be applied or an ice-cap laid on the inflamed joint. When the disease becomes more chronic, then ointments like belladonna and mercury and 10-per-cent. ichthyol may be used and the joint firmly bandaged with either a flannel or rubber bandage or it may be strapped with adhesive plaster. Sometimes small blisters around the affected spot tend to relieve pain.

Large effusions into a joint may be tapped under the strictest antiseptic precautions. If pus forms, the joint may be washed out with a 1 to 5000 solution of bichloride of mercury. The injection of iodoform and glycerin emulsion 10-per-cent. into and around the joint is spoken of favorably by Senn and others.

Excellent results obtained from a mixture of formalin and glycerin, 1 to 5 per cent., in the treatment of surgical tuberculosis. As an injection into abscesses connected with diseased joints, this mixture is superior to an emulsion of iodoform. Hahn (*Centralb. f. Chir.*, No. 24, '99).

Inasmuch as the diseased process is so often situated in the bone, Macnamara has advocated trephining. I have often drilled the affected bone with numerous holes about three-sixteenths inch in diameter, and it has been of great service. Rarely pus may be found, but usually not. The drilling, however, tends to stop the progress of the disease, and is worthy of more extended use than is now practiced.

The question of operative treatment in tuberculous cases is the cause of much difference of opinion. One fact is well settled, and that is that conservatism is more desirable in orthopædic cases than in those of general surgery. Abscesses may be opened if they pursue an acute course with considerable pain and disturbance of the patient. If they are cold, chronic, and not too large, they are best let alone, as many of them will entirely disappear. Infection is very liable to attack a discharging collection of pus, and the general health may become affected. Abscesses may be emptied with a trocar, washed out with salt solution or weak antiseptic, and then injected with 10-per-cent. iodoform emulsion, an ounce or more being used. This will probably have to be repeated, perhaps two or three times. Sometimes the abscess keeps on discharging without any tendency to heal until death from exhaustion or general tuberculosis supervenes. Resection of joints is to be resorted to when the suppuration is so profuse as to endanger life and the patient is of a suitable age. Resections in young children interfere so much with growth as not to be advisable. In these, partial resections or erosions are to be preferred, the joint being opened and the affected tissue cut and gouged away. Operative measures are more advisable as the patient increases in age. Amputation is only to be resorted to as a life-saving measure, usually for profuse suppuration with entire disorganization of the joint. As a rule, patients are to be kept in bed until all evidence of acute trouble has gone and remained away for two or three months. Then the patient may be allowed to go about with some appliance to keep the joint from moving, or with a high shoe and crutches. These protecting appliances are to be worn for months after all

evidence of active disease has passed away. For walking cases very nice appliances may be made of silicate of soda, which can be used for many months. When the patient can afford the expense, an apparatus made by the instrument-maker is much preferable for all of the tuberculous cases. Its style will vary with the character of the case.

General treatment is to be used along with the local. The remedies are well known: codliver-oil with creasote, syrup of the iodide of iron, tincture of nuxvomica, and compound syrup of the hypophosphites are those most commonly used. The late Dr. Goodman used a prescription composed of:—

R Bichloride of mercury, $\frac{1}{24}$ or $\frac{1}{48}$ grain.

Fowler's solution of arsenic, 1 to 3 drops.

Tincture of iron, 3 to 8 drops.

Syrup of orange-flowers, 1 drachm.
—M.

It is a very efficient combination, and acts well in many cases. Careful, persistent, protective, and conservative treatment is the key-note of success in the management of tuberculous joint diseases:

Mechanical treatment, especially fixation, should be used in the acute conditions in childhood. Exploratory interference, where discretion is used, with a view to removal of isolated foci, is advisable in many cases in children, and is to be urged in the majority of the recrudescences, if seen early. Recognition of the fact that patients with hip disease, Pott's disease, and tumor albus have tuberculosis just as much as if they had phthisis, and should be treated accordingly, must be insisted upon. C. F. Painter (Boston Med. and Surg. Jour., Jan. 8, 1903).

The best treatment for tubercular arthritis of children consists in a combination of the methods of immobilization and extension, together with injec-

tions of glycerin-iodoform emulsion into the joint and into any abscesses which form. The writer uses 10 cubic centimetres of a 10 per cent. emulsion, injecting it about once every three weeks. Ambulatory treatment is instituted after the acute stage of the disease has passed—that is, after all pain has disappeared—but the correction of any existing deformity is secured before resorting to it. To reduce deformities the best results are obtained by performing reduction gradually, at several operations if necessary. Immediate forcible reduction is condemned because it may give rise to general tubercular infection. If ambulatory treatment is followed by a rise of temperature the child is again confined to bed. As a rule cold abscesses should not be incised because of the danger of fistula formation and subsequent septic infection. When, however, in spite of the iodoform injections, the abscess continues to cause violent pain and fever, or when it threatens to perforate the skin, then operation is advised; also when there is reason to believe that the primary focus of infection has been cured. If a cure is not obtained by the above outlined conservative treatment, if abscesses continue to form, if fistulæ discharging sanious pus exist, or if from the beginning there has been a tendency to the formation of large sequestra and areas of caseous degeneration, the diseased portions of the joint are removed. Whenever possible the epiphyseal interspaces are preserved. The writer advises against typical resection, and practices amputation only when the entire joint has been destroyed, when general tubercular infection is marked, or when amyloid degeneration of the internal organs is present. The local conservative treatment is supplemented by hygienic measures, and the administration of codliver-oil, arsenic, or iodide of potassium. Hoffa (Revue de Thérap. Medico-Chir., May 15, 1903).

Loose Bodies in Joints.

Symptoms.—The symptoms of the affection are marked, and are due to inter-

ference with the function of the joint. The knee is the joint most often affected. The patient, while walking, is apt to experience a severe pain in the joint and may either fall or else hold the joint stiff. It may become locked. In some cases the patient can so manipulate the part as to free the loose body and then walking again is possible. These sudden attacks of disability are followed by a swelling of the joint and all the symptoms of an acute synovitis. These repeated attacks supervening on the original injury are apt to cause the joint to be constantly in a state of low chronic inflammation which is more or less disabling.

Besides the pain and stiffness which may be produced, the patient has a continual sense of distrust, which causes him to avoid using the joint freely, and thus interferes with walking. In many cases there is nothing apparently wrong with the joint until the moment of pinching or jamming of the loose body as the joint is in motion. These patients are usually skillful in finding and localizing the loose body, but not always. Often it disappears on the slightest movement, not to be discovered until it again intrudes itself upon the patient's notice at some inopportune moment.

Loose bodies in joints are usually the result of injury or disease. Many are due to mere masses of fibrin and show little or no structure. Whether simple effused blood can become so firm and compacted as to form loose bodies is questionable; ordinarily such effused blood is absorbed. It is quite probable, however, that some of the milder forms of foreign bodies are of this character. The synovial membrane is, however, a prolific source. Usually as the result of injury the synovial fringes may become inflamed, condensed, and finally sep-

arated, leaving the detached body floating free in the joint. This is shown to be the case by some foreign bodies' being covered with synovial membrane. They are not only fibrinous in character, but also cartilaginous. Cartilage-cells are normally found in the synovial fringes, and it is easy to see how an injury could start up sufficient action to form an appreciable lump. Sometimes the bodies are found with a pedicle, by which they are still attached to the synovial fringes. Some of the cartilages may be so severely injured as to be partially or wholly detached or torn off. The fragment then floats free in the joint or if only partially detached becomes parted later on.

There are three theories to account for the origin of these bodies: 1. The nucleus is supposed to be a clot of fibrin, a bit of torn fringe, or a fragment of semilunar cartilage. 2. Such bodies are originally osteophytic growths on the lips of the articular surfaces, and become "nices" by being broken off. 3. They are actual bits of articular cartilage set free by traumatism. The author considers that this latter theory is the correct one in the vast majority of cases. E. A. Godman (Boston Med. and Surg. Jour., Oct. 15, 1903).

The semilunar cartilages are particularly liable to be the seat of injuries. Sometimes a piece of bone is detached along with the cartilage, as occurred in a patient of mine. These bodies not infrequently contain calcareous or true bony matter. In osteoarthritis or arthritis deformans loose bodies are frequent and may exist in great numbers. This is only what would be expected of a disease in which the various cartilaginous and fibrous structures are so extensively affected.

There is usually a clear history of injuries in these cases, to which the origin of the trouble can be traced.

The bodies vary in size; they are usually convex toward the joint, and concave toward the bone. They consist chiefly of cartilage, but may contain a fragment of the subchondral bone. It is probable that these bodies may disappear spontaneously, as has been observed experimentally in animals; but the disease is quite distinct from arthritis deformans. There are never any changes in the bones or cartilages characteristic of the latter disease. There is, at the most, a localized thickening of the capsule, or the formation of fringes. An important fact is that the patients recover a healthy joint after removal of the loose body. König (Edinburgh Med. Jour., Sept., 1900).

or three deep interrupted sutures to close the wound is all that is necessary. If pressure is relaxed before the pin is thrust into the loose body, it may slip away into the joint and be lost. They cannot be made to appear at will. The favorite places for them are on each side of the patella, especially the outer side and down below and to its inner side. In cases which will not submit to operation, some device may be utilized to alleviate the affliction. A simple elastic knee-cap may afford some relief. Sometimes the body only causes trouble when either excessive flexion or longitudinal



Loose bodies in the knee-joint. (Schüller.)

Treatment.—In loose bodies traceable to injury removal is, if possible, indicated at once. The procedure which I have found most satisfactory is as follows: The surgeon feels for the loose body, and when found crowds it into some corner and holds it firmly there with his thumb. Still keeping up the pressure the patient is etherized and an incision made with the other hand down to the capsule of the joint directly over the loose body. A pin is then thrust into it and an incision made directly through the capsule and the body turned out. Special suturing of the capsule is not necessary; two

rotation of the bones of joint takes place; when this is so dressings or apparatus that limit flexion and to a great extent prevent rotation may be applied. When the loose bodies are the result of osteoarthritis they are apt to be so numerous as to preclude the giving of relief by an operation for removal.

Analysis of 105 cases of floating cartilages in which antiseptic operations have been performed, with but 1 death. Woodward (Boston Med. and Surg. Jour., Apr. 25, '89).

Absence of danger in free incisions into joints made under aseptic precautions emphasized, in order to remove loose

bodies which are firmly wedged between the articular surfaces, without injury to the joint. A limited or external longitudinal incision is made, the leg is bent inward or outward, so as to separate the joint-surfaces sufficiently to remove the body (see figure). If not carried too far, this bending does not injure the ligaments. Schüller (*Deut. med. Woch.*, Aug. 7, '90).

Ten hundred and forty-seven loose bodies removed from a single knee-joint of a man of 22 years. James Berry (*Brit. Med. Jour.*, May 19, '94).

In foreign bodies in the joints, treatment may consist of wearing an apparatus (such as Marsh's, for prevention of semilunar-cartilage dislocation) to prevent full movement of the joint, and thus avoid the painful locking and injury to the synovial membrane, or, what is incomparably superior when perfect asepsis can be obtained, operation may be performed. In locating the body the local anæsthesia of Schleich is of the greatest value, as the active co-operation of the patient is frequently essential. Attempts to fix the body by a pin before anæsthesia often prove unsuccessful, but if the body can be coaxed to one side of the joint and, while it is held in its superficial position, the articulation is flexed and held in that position by a bandage at a lower and upper point upon the limb, the body will not only often remain rigidly in position, but will shoot out as a pea from a pod when the overlying capsule is incised. T. S. K. Morton (*Phila. Polyclinic*, Jan. 25, '96).

The formation of floating bodies may be prevented by immobilization of the joint. When floating bodies have been formed, their removal by operation is strictly to be insisted upon, the more so and the sooner because the disturbance which they cause increases with time. Max Schüller (*Aerztlichen Sachver. Zeit.*; *N. Y. Med. Jour.*, Apr. 4, '96).

Analysis of cases of floating cartilage of the knee treated by operation between 1885 and 1895. The total number of cases considered to have been reported in sufficient detail to warrant attention was 72. Of these 23 were pedunculated and 49 non-pedunculated. Besides bodies de-

tached by slight injury, portions might be chipped off from the ends of the bones as a result of severe injuries.

The majority of the cases were examples of bodies detached by a process the nature of which is as yet unknown. In 1860 the cases occurring up to that time had been collected. Of the one hundred and thirty-five that had been operated upon by direct incision, there were 74.8 per cent. of successes, 21.4 per cent. of deaths, and 3.8 per cent. of failures. Muller, in 1886, had collected one hundred cases with ninety-six recoveries and four deaths. Between 1885 and 1895 no fatal results recorded. Sixty-seven cases tabulated with reference to the function of the joint after operation. It had been found that in 22 per cent. there had been some disability, in 13 per cent. more or less limitation of motion, and in 4 per cent. ankylosis.

Sixty-two out of the 72 cases analyzed in this paper made a complete recovery; in 16 per cent. more or less disability was acknowledged. Of the 10 unfavorable results 6 occurred after the removal of pedunculated bodies, and 4 after operations for the removal of non-pedunculated bodies. Of the 6 unfavorable results 3 were unavoidable from the operative procedures required, and 3 were due to disease existing prior to operation and persisting after it. P. R. Bolton (*Med. Rec.*, Apr. 25, '96).

In operations for loose cartilages in the knee-joint their removal preferred to suture. In all of the twelve cases personally operated upon the functional result has been perfect and the recovery afebrile. Marsh (*Brit. Med. Jour.*, Mar. 5, '98).

Report of 38 operations for synovial fringes, injured semilunar cartilage, loose cartilage, coagula, exploratory incisions, etc. Operations upon the joints need not be feared more than operations upon other parts of the body; the importance of operation emphasized, not only to relieve a definitely recognized condition, but also for the purpose of exploration. Joel E. Goldthwait (*Boston Med. and Surg. Jour.*, Sept. 20, 1900).

Forty-four cases of loose bodies in joints subjected to the following opera-

tion, which was followed by healing by first intention in all. After thorough disinfection the loose body was fixed by the finger of an assistant in that part of the joint nearest to the skin. An incision was then made through the capsule. The loose body was grasped with a pair of hooked forceps and withdrawn. The capsule was closed by a few catgut sutures, and the skin by a silk thread. The joint was splinted for eight days, and on the tenth or twelfth day motion was begun. When this caused any synovial exudate the patients wore a light pressure bandage. All the joints treated showed secondary changes incident to the presence of loose bodies. Often these changes were most marked. Schmieden (*Archiv f. klin. Chir.*, B. 62, H. 3, 1901).

Ankylosis.

When from injury or disease a joint loses its function and becomes stiff, it is said to be ankylosed. Ankylosis may be either bony or fibrous. The former has been called true and the latter false ankylosis. In bony ankylosis the bones entering into the formation of the joint have become united by bony tissue. In fibrous ankylosis either the articular ends of the bones are united by fibrous bands going directly from one to the other or else motion is restricted by changes in and around the capsule of the joint. The name is not applied to loss of motion due to changes in structures unconnected with the joint, such as contracted tendons or muscles or cicatrices from burns. All inflammations of joints from whatever cause, if violent enough and long continued, are liable to cause ankylosis. Such affections as destroy the articular surfaces of the joint are very liable to be followed by ankylosis. Suppuration oftentimes, but not always, results in a more or less complete loss of motion. Serious joint disease almost always results in some loss of movement of the joint, but a certain slight amount may remain; hence one speaks of restricted

motion or one may perhaps be allowed to use the term "incomplete ankylosis" to express this condition.

The question of ankylosis is determined by the severity of the inflammation, the duration of the inflammation, the presence of intra-articular pressure, the subsequent cicatricial contraction of soft parts around the joint, the tissues involved, and the amount of destruction of bone and cartilage. Inflamed joints treated upon the plan of absolute immobilization and the relief of intra-articular pressure furnish by far fewer cases of ankylosis, limited motion, and deformity. Phelps (*N. Y. Med. Jour.*, May 17, '90).

To diagnose ankylosis one must exclude the rigidity caused by muscular contraction; therefore in doubtful cases the examination should be made under an anæsthetic. The production of pain by attempted motion is good evidence that complete ankylosis is not present, because it is the movement of the parts that causes the pain. An approximate idea of the extent of the stiffness may be obtained from the clinical history of the case as to whether the disease has been violent in character and long in duration.

Treatment. — This is preventive and curative. The attempt to prevent the occurrence of ankylosis in joints that are the subject of disease by means of passive motion are usually not only futile, but positively harmful. Any violent or extensive movements only increase the inflammation and activity of the disease already present. The joint has enough to do to attend to the original disease without having to contend with the added violence of misapplied surgical energy. The amount of pain experienced is a good guide to the amount of motion to be practiced, if it is severe or long continued it is evidence that the movements have been too extensive. It is best to wait until the active evidences

of disease have disappeared before attempting movements. In tuberculous and other diseases the attempt to restore motion is apt to relight the original trouble; therefore it is well to have as long an interval intervene as possible. Restoration of motion is only possible in cases of fibrous ankylosis, not bony, and when the disease has not been too extensive. The utmost that can be hoped for in many cases is the placing of the limb in a more useful position. When it is desired to restore motion in a stiff joint, the patient should be anæsthetized and the joint first flexed and then extended; this should be repeated until as much motion as possible has been secured. The part is then kept at rest and ice-bags applied until the resultant inflammation has subsided, then mild passive motion is to be employed for some time until it is seen whether anything has been gained. If not, then it is useless to repeat the procedure, for if no motion has been gained some will probably have been lost, and with each succeeding effort the condition of the joint is worse. Care must be taken not to fracture the bones in making the necessary manipulations. The bones from long-continued disease are apt to be somewhat atrophied and not so strong as they normally are. If it is desired to increase the extension of a joint, a good plan is to apply some sort of a splint or apparatus that holds the part in its most extended position and then remove it daily and apply passive motion and again replacing the apparatus. An apparatus producing gradual pressure, such as the Strohmeier screw, is often serviceable when it can be applied.

Case in which, as the result of forcible breaking up of ankylosis at the knee, there occurred gangrene, necessitating amputation through the thigh. Stavely (Med. Record, Oct. 20, '88).

Case of fatal fat-embolism after forcible straightening of both knee-joints. Ahrens (Beiträge zur klin. Chir., B. 14, H. 1, '95).

Stiffness arising from injuries such as fractures are usually due to their involving the joint and from misplacement of the fragments directly interfering with motion or else to pouring out of callus and non-bony effusion from the injured parts. Ankylosis from the former is to be prevented by a more correct apposition of the fragments before they have had time to become fixed in their abnormal position. Ankylosis from the latter is to be avoided by gentle and persistent passive motion.

In fibrous ankylosis, electrolysis: continuous current passed directly through the joint, with the negative pole nearest the adhesions, amount given ranging from 40 to 150 milliampères. F. W. Gwyer (N. Y. Med. Jour., June 8, 15, '95).

Bony ankylosis is to be treated either with a view of bettering the position of the part or to the formation of a false joint. If the former is aimed at, then osteotomy is of service, especially in cases of hip disease in which the neck of the femur is divided or a subtrochanteric osteotomy performed; also to remedy a bad position of the foot. In the knee the amount of deformity is usually so great as to require resection; here osteotomy is not applicable.

Case of excision of both knees for angular ankylosis. Newbolt (Lancet, Nov. 24, '95).

In the shoulder-joint ankylosis is not so disabling as in other joints, and usually no operation is advisable. If, however, motion is desired, it can be obtained by resection of the head of the bone. In the elbow-joint good results are obtained by a resection of the joint; good and serviceable motion is often obtained. When too little motion results,

it is usually because too little bone has been removed. As healing progresses, what at first looks like a flail-joint becomes a very serviceable one. Ankylosis of the spine has been treated by forcible straightening of the kyphosis by non-operative means, but its true value as yet is undetermined. In some cases new bone has not formed to fill up the resultant gap, and consequently relapses are very liable to occur. Straightening in several sittings is better than to completely straighten at one. The articulation of the lower jaw becomes ankylosed at times, and is to be treated by liberal resection of bone, preferably done from within the mouth. The treatment of ankylosis of the finger-joints depends on the occupation of the individual. In people who have manual work to do, as machinists, carpenters, etc., a stiff finger is so much in the way and so often becomes injured that it is sometimes advisable to amputate it. The patient, however, should be the one to decide as to the advisability of amputation, and it is best to wait until by trial he finds the affected finger useless.

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JUNIPER.—Juniper is the fruit or berries of the *Juniperus communis*, of the family *Coniferæ*, an evergreen of Northern Europe and America. The berries contain 2 to 2½ per cent. of a volatile oil, upon which its medicinal effects chiefly depend, a non-crystallizable principle (juniperin), and from 15 to 30 per cent. of sugar, etc. The volatile oil also exists in the leaves and other parts of the plant, and by first bruising and then macerating them in alcohol or spirit the liquor commonly known as gin is produced. The oil of juniper obtained from the wood is inferior to that

distilled from the berries, which is the official form of oil from which the spirit and compound spirit are made. The compound spirit is the pharmacopœial substitute for gin and is to be preferred to the latter, which is frequently adulterated with oil of turpentine.

The oil of cade (*oleum cadinum*, U. S. P.), obtained by destructive distillation from the wood of *Juniperus oxycedrus*, is a thick, black, empyreumatic oil resembling and having the odor of tar, and having an acrid disagreeable taste. It is soluble in ether, chloroform, and carbon disulphide.

Juniper-tar (= oil of cade) contains (1) hydrocarbons (boiling-point, 210° to 400° C.), which form its greater part; (2) acetic acid and its homologues; (3) phenols and allied bodies; and (4) resinous substances, which form the residuum after distillation. (a) The chief difference between the phenols of coniferous trees (pine and juniper) and others (beech, birch, aspen, etc.) is that the latter contain diphenols and bodies derived from triphenols (pyrogallol), with small quantities of monophenols, while the former contain only diphenols, chiefly derivatives of pyrocatechin (guaiacol and its homologues, methyl- [= creosol] ethyl- and propyl- guaiacol). (b) Juniper-tar is poorer in phenols than that of pine or aspen. (c) It is less acid and has less disinfecting power than the other tars. (d) As a 5-per-cent. mixture with water its disinfecting action is almost *nil*. (e) An alkaline solution (5-per-cent. tar in 1-per-cent. KOH solution) has a marked disinfecting action, killing a two-day-old culture of intestinal bacteria from a body dead of cholera when mixed with it in equal parts in 20 to 30 minutes, a culture of typhoid bacilli in 2, and of *B. pyocyaneus* in 10 minutes. Still this action is inferior to that of an alkaline solution of pine-, birch-, or aspen-tar. (f) Anthrax-spores are killed by pure juniper-tar in 7 to 9 days, by its 5-per-cent. alkaline solution in 24 hours. (g) The alkaline solution has but a feeble action on pure cultures of tubercle bacilli,

and does not kill them after 24 hours, for all guinea-pigs inoculated with these insufficiently-sterilized cultures died about the 60th day. (*h*) Juniper-tar is 9 times as expensive as pine, and $4\frac{1}{2}$ times as birch. Witold de Schulz (Arch. des Sci. Biol. de l'Institut. Imper. de Méd. Expér. à St. Petersburg, Tome v, Nos. 4, 5, '97).

Preparations and Doses.—Oleum juniperi, 1 to 15 minims.

Spiritus juniperi, $\frac{1}{4}$ to 1 drachm.

Spiritus juniperis compositus, 1 to 4 drachms.

Physiological Action.—The diuretic action of juniper is due to a stimulating effect upon the renal structures, which may reach irritation when the drug is administered in excessive doses. Anuria may thus be induced. These effects are produced by the volatile oil, which, first absorbed into the general system, is then eliminated through the kidneys. It also has a stimulating action upon the gastro-intestinal tract.

Poisoning by Juniper.—Juniper in overdose produces an irritant action on the gastro-intestinal canal and upon the genito-urinary tract. Its action upon the kidneys may cause strangury, priapism, hæmaturia, suppression, and uræmic intoxication. A violet-like odor may be detected in the urine. A rash like that following the use of copaiba is sometimes noticed.

Treatment of Poisoning.—If seen early, the stomach should be washed out with a stomach-siphon, and diluent and demulcent drinks used freely. An enema of laudanum or the use of morphine by hypodermic injection will relieve the poisonous effects, while stimulants will avert collapse.

Therapeutics.—GENITO-URINARY DISORDERS.—As a stimulant to the genito-

urinary tract juniper has long been considered valuable. It is especially indicated in chronic disorders, as chronic nephritis, chronic pyelitis, and chronic catarrhal inflammation of the bladder. Active acute inflammation contra-indicates its use. In the later stage of scarlatinal nephritis, when reaction has set in and the renal secretory apparatus is in an atonic condition, it is of great service. It is a very satisfactory remedy in various forms of dropsy. An infusion of the berries (1 ounce to the pint of boiling water) with the addition of $\frac{1}{2}$ ounce of cream of tartar may be taken daily, with benefit in chronic Bright's disease; it relieves markedly the œdema and effusions incident to that disorder.

Juniper-berries tried in a case of renal dropsy with good results. Goldschmid (Corres. f. Schweizer Aerzte, Dec. 1, '88).

As a diuretic for young children, 2 to 3 teaspoonfuls of the juice of the common juniper-berries are highly recommended. Vogel (Annual, '90).

Juniper gives relief in passive congestion of the kidneys and the lumbar pain, or sensation of weight across the lumbar region, so frequently experienced by aged persons, especially if the kidneys are inactive. Prostatorrhœa and gleet are generally benefited by juniper in moderate doses.

GASTRO-INTESTINAL DISORDERS.—Juniper is a valuable stomachic. In small doses it increases the appetite and aids digestion. A few drops of the compound spirit in hot water will relieve the flatulence and pain of infantile colic. Gin is a favorite domestic remedy for pain associated with menstrual disorders. A few teaspoonfuls in hot water combined with external applications of heat generally gives prompt relief.

K

KERATITIS. — Gr., κέρας, cornea, and ιτις, inflammation.

Definition.—Inflammation of the cornea.

Varieties.—The varieties of keratitis are interstitial, neuropathic, malarial, dendritic, herpetic, punctate, phlyctenular, bullous, pannous, traumatic, striate, suppurative, and xerotic keratitis.

Symptoms.—The most constant symptom is opacity; and this may be the only objective symptom present. It may vary from the slightest increase of the haziness that is visible in the normal cornea, under strong oblique illumination, with a good magnifier, to complete opacity through which no trace of the iris or pupil is visible. The opacity always causes impairment of vision, proportioned to the extent to which it invades the part of the cornea in front of the pupil.

Redness is manifest, not usually in the cornea itself, but in the vessels at its border, which supply it with nutrient fluid; and the enlargement of which gives rise to the pericorneal zone. In chronic keratitis, however, as during the later stages of corneal ulcer, and in pannus, trunks of considerable size may be seen arising from the vessels at the corneal margin extending on the cornea, and dividing, to be distributed to the superficial corneal layers. In interstitial keratitis great numbers of extremely-small vascular loops extend from the margin into the deep corneal tissue. As the inflammation goes on to resolution, the corneal vessels atrophy and in most cases entirely disappear.

The pain of keratitis is usually severe. It may be that of a foreign body in the eye, a smarting, burning, or severe aching pain. It is commonly attended with

photophobia, which may become intense, and with increased lacrymation. Swelling may occur in corneal inflammation, but it is inconstant and of little consequence.

Loss of substance, ulceration, is a far more important symptom. In many forms of inflammation the resulting ulcer is the most significant and most serious symptom. Its characteristics are closely identified with the variety of keratitis, and will therefore be considered under the special symptoms peculiar to each variety. In all corneal ulcers, however, extension usually occurs by the breaking down of an infiltrated area; and, while active, the surface of the ulcer, when wiped with a pledget of cotton, lacks the smooth reflex of the normal corneal surface. Before the ulcer begins to heal the points of infiltration disappear and the ulcer is said to be "clean." Its surface, too, becomes coated with epithelium, and, although not so even as the normal corneal surface, appears to have the same polish. As the loss of substance is made good with new-formed tissue, the lack of transparency in the scar-tissue gives rise to an opacity, which will be most noticeable some weeks after all signs of active inflammation have ceased. Such corneal opacity, and the possibility of perforation of the cornea, and its sequels (see CORNEA, volume ii) are the special dangers of ulcerative keratitis.

Case of aspergillus keratitis: a supposedly rare variety of corneal inflammation. The condition is much more common than has been thought. It is attended by intense pain in the eye and development of a brownish or black mass within the substance of the cornea. Removal of the mass early in the case is followed by uninterrupted cure. Fail-

ure to recognize the condition is followed by sloughing of the cornea and in some cases by the loss of the eye. J. M. Ball (*Amer. Med.*, July 6, 1901).

INTERSTITIAL KERATITIS begins with photophobia, slight redness, and irritability of the eye. Opacity appears faintly near the middle of the cornea, involving the deeper layers, and increases from day to day, and extends toward the periphery. Then at the border, usually the upper or lower border, the cornea becomes opaque, and fine loops of deep vessels push out in it, and extend gradually farther toward the centre, giving the tissue they invade a characteristic "salmon" color. Iritis or choroidal inflammation is liable to attend this form of keratitis, and may be manifest before the opacity of the cornea wholly hides the iris and pupil. Usually both eyes are affected. The course of this form of keratitis is essentially chronic, usually running through several months, and sometimes years before it subsides. The corneal surface often becomes quite uneven; but is rarely ulcerated. The disease generally affects both eyes; and usually occurs during childhood or youth, but may be met in early adult life, or even later. The patient frequently presents other evidences of inherited syphilis, particularly the Hutchinson teeth, or the nasal deformity; or the symptoms may be those that are grouped under the term *scrofula*.

Instance of conjunctival interstitial keratitis of syphilitic origin. The case was seen directly after birth. The lids were swelled, and there was a dirty-yellow discharge from the conjunctiva. The corneae were dull gray. Barabasher (*Vestnik of Ophthal.*, May-June, '96).

A condition of keratitis interstitialis annularis in an eye with increased tension and intense congestion. Vision equaled ability to see to count fingers at four feet. There was a ring of deep and dense opacity between one and two

millimetres in width, entirely surrounding the central two-thirds of the corneal area. The patient, a man 67 years of age, was suffering from hay fever. The acute symptoms quickly subsided under treatment, but the opacity persisted for about two months. Moulton (*Annals of O., O., and L.*, July, '96).

The corneal lesions of acquired syphilis may take one of two forms. The commonest, though still a rare disorder, is interstitial keratitis, indistinguishable from that seen in hereditary syphilis; this is a late secondary or tertiary event, and rarely occurs within two years of infection. It is more commonly unilateral than in the hereditary disease, and has generally a favorable issue. The other form is a true punctate keratitis, characterized by groups of circumscribed grayish spots appearing rapidly in the substance of the cornea, and as rapidly disappearing. This is a much rarer condition; it cannot be, except by the most careless observers, confused with ordinary "keratitis punctata." Sydney Stephenson (*Ophthalmoscope*, Nov., 1903).

NEUROPATHIC KERATITIS, or neuropathic keratitis, is usually marked by diminished sensitiveness of the cornea to touch as compared with the sound eye. It also may be attended with iritis, but is commonly confined to one eye. The liability to it increases with age; and there is likely to be other evidence of involvement of the ophthalmic branch of the fifth nerve, as herpes zoster, neuralgia, or distinct paralysis. Curiously enough, it is possible to remove totally the Gasserian ganglion, and by careful protection of the eyes during the first few weeks, to escape any neuropathic keratitis. There is very likely to be ulceration, although this may not occur; and the ulcer may become infected and the keratitis lose its characteristic features. Its course is quite chronic; but healing, usually with more or less opacity, mostly occurs in three to six months.

MALARIAL KERATITIS.—Keratitis quite neuropathic in its clinical character may arise in malarial persons in connection with fifth-nerve lesions, especially malarial neuralgia. But in a more specific form, as in a linear branching ulcer, it also occurs with impaired sensibility to touch, and some opacity of the affected part of the cornea.

Case of malarial keratitis in which the inflammation was manifested as a peripheral annular parenchymatous infiltration separated from the corneal margin by a zone of clear tissue. The opacity consisted of numerous minute points joined by fine, grayish lines sometimes so closely packed together, however, that the intervening striæ could not be distinguished. Examination of the blood failed to show any malarial organism. Tenderness in the supra-orbital notch was marked. De Schweinitz (Phila. Polyclinic, July 6, '95).

DENDRITIC KERATITIS is a rare disease also characterized by linear branching ulcers, which tend to extend by the formation of new branches. These branches are usually straight lines meeting each other at definite angles. It may be acute, with severe pain, or chronic, with but a slight irritation.

HERPETIC KERATITIS occurs late in the acute infectious fevers and in diseases of the air-passages. Small vesicles form on the cornea and rupture, giving rise to minute ulcers.

PUNCTATE KERATITIS.—The term *keratitis punctata* is usually applied to the small, rounded dots of opacity which form on the posterior surface of the cornea in iritis and cylitis. Isolated dots of denser opacity in the midst of a somewhat hazy cornea mark a chronic disease of probably syphilitic origin, not attended with much redness or photophobia. Another form called *superficial punctate keratitis*, marked by dots and lines of opacity just below the anterior epithelium of the cornea, is attended

with a good deal of conjunctival redness, pain, and lacrymation. It is liable to relapse, and may last for months.

PHLYCTENULAR KERATITIS occurs commonly in young children, in close association with phlyctenular conjunctivitis. The phlyctenule containing cells and fluid arises on the surface of the cornea, and in a few hours, or a day or two, ruptures and gives rise to a small ulcer. Later a few branching vessels forming a long narrow leash, usually somewhat in a direction of a radius of the cornea, may make their way out from the nearest portion of the limbus to the region of the ulcer. This is especially likely to occur if several phlyctenules have successively arisen on the same part of the cornea. The condition is then spoken of as *superficial vascular* or *fascicular keratitis*. The ulcers rarely perforate the cornea, but may do so. This form is particularly liable to relapse. It is often attended by the most severe and obstinate photophobia.

BULLOUS KERATITIS is marked by recurrent attacks of severe burning pain followed quickly by the raising up of a large bleb or bulla on some part of the cornea. The epithelium forming the anterior wall of the bleb quickly ruptures, leaving loose shreds of epithelium and a broad abraded surface, which in a few days heals over, and some months may pass before there is a recurrence. Two forms of the disease are recognized: one occurring in eyeballs that have been the seat of severe inflammation of the uveal tract, and have undergone degenerative changes; and the other due to previous wounds of the cornea causing extensive loss of the corneal surface in an otherwise-healthy eye.

Primary bullous keratitis arises as follows: Some variable times after an abrasion of the cornea by the finger-nail, a twig, or such object, there occurs an at-

tack of severe pain in the eye, which always begins in the morning when the patient wakes up. It usually lasts a few minutes, ceasing with the occurrence of an abundant flow of tears. These attacks recur with varying frequency. There is photophobia, hyperæmia, œdema of the lids, etc. At this stage there is discovered a large bulla of the cornea, which is frequently only half-filled with clear fluid and can be displaced on movement of the lower eyelid; a small spot of cornea is seen to be dull, and the bleb or its remains can be picked off with forceps, leaving a large, denuded surface with uneven margins extending to one-fifth or even as much as one-half of the area of the cornea. After three days or a little more, the denuded surface is again covered, but may break down soon thereafter, and the same process be repeated many times. There is usually several months' delay from the time of the original accident until the development of the bulla. Edmund Jensen (*Arch. d'Ophtal.*, Apr., '98).

Bullous keratitis; a case of this rare affection due to cataract and complete posterior synechia of the iris. The usual treatment of opening the bullæ and touching the raw spots with nitrate-of-silver solution was first adopted. This, together with atropine, was fruitless. Iridectomy was then done under cocaine. At first this promised success, but suddenly new bullæ appeared and the eye was enucleated. E. O. Sisson (*Jour. Amer. Med. Assoc.*, Aug. 25, 1900).

PANNOUS KERATITIS.—Pannus is an inflammation and vascular opacity of the cornea, occurring in trachoma, after the palpebral conjunctiva has been severely affected. The portion of the cornea involved is that which comes habitually in contact with the lids; most frequently the upper part, but sometimes also the lower. The part affected is somewhat thickened with an irregular surface, and more or less hazy. It is usually bounded by a horizontal line marking the habitual position of the lid-margin. Large branching trunks of superficial vessels

pass out upon the cornea, from the vessels of the limbus; their distribution is sharply limited by the line bounding the affected area. Ulceration is not infrequent, but is not characteristic of this form of keratitis.

TRAUMATIC KERATITIS.—Injuries to the cornea may set up a general inflammation of the membrane; but more frequently they cause loss of substance of the cornea, and thus originate corneal ulcers. If small and not affected, such ulcers heal quickly, with little pain; and leave only a temporary opacity proportioned to their extent. If they involve an extensive surface, even though quite superficial, amounting to little more than an abrasion removing the corneal epithelium, they may be extremely painful. If, as often occurs, they are infected, they present the features of a suppurating ulcer.

Clinical and pathological study of four cases of ring infiltration of the cornea. In every instance the affection followed a perforating septic wound of the cornea, and the ring infiltration occupied precisely the same position, its outer edge being one millimetre distance from the corneal margin, irrespective of the position of the wound. Microscopically, the cell-accumulation between the laminae of the cornea was found to be densest at a position almost equally distant from its anterior and posterior surface, or slightly nearer the anterior. Collections of cells were also sometimes found between Descemet's membrane and the corneal substance. E. Treacher Collins (*Ophthalmic Review*, Aug., '93).

Injuries to the globe occur generally to the nasal or upper aspect of the bulbus, exceptionally to the temporal side; the cornea ruptures oftenest in youth, the sclera in old age. Müller (*"Ueber Rupture der Corneo-scleral Kapsul durch Stumpfe Verletzung"*).

STRIATE KERATITIS is seen after injury, especially after operations, like cataract extraction. In this case a num-

ber of fine-gray streaks, more or less perpendicular to the corneal incision, are noticed, from a few hours to a week or so after the operation. This form may also occur after an injury that has caused bending of the cornea. It usually ends in resolution.

SUPPURATIVE KERATITIS always includes the formation of a corneal ulcer; and it is probably always due to some form of infection. The ulcer may be there first, and become infected, or the infection may occur in a previously-sound cornea, giving rise to an abscess; which in time breaks through, if not incised, forming the ulcer. In some cases the posterior layers of the cornea break down, forming an ulcer on the posterior surface.

Suppurative ulcer is marked by a margin which, at least at some points, is infiltrated, as the floor may be infiltrated. The tissue thus becoming involved in the ulcerative process is swelled, softened, yellowish in color, and swarming with bacteria. The germs most commonly present are the pus-cocci or the pneumococcus (*diplococcus lanceolatus*). This latter form gives rise to what is known as the serpent-ulcer: an ulcer that is liable to spread irregularly over a large part of the cornea without tending to rapidly perforate it. The margin of such an ulcer is generally of irregular outline, and abrupt or overhanging. The suppurating ulcer is often attended with hypopyon.

XEROTIC KERATITIS begins with dryness of the conjunctiva; and a general haziness of the cornea, which soon leads to ulceration, perforation, and loss of the eye. Both eyes are generally affected; the disease occurs in feeble infants that rarely survive.

Diagnosis.—Keratitis is recognized by careful inspection of the cornea under

the proper conditions of illumination. Slight opacity is rendered most evident by strong oblique illumination which should be so arranged that the light will be concentrated upon the cornea, while the iris behind it is left in comparative shadow, to furnish a dark background. Localized points of opacity in front of the pupil may also be studied with the ophthalmoscope, using the strongest convex lens behind the mirror, and looking from about the focal distance of the lens in front of the eye. Ulceration is best discovered by placing the patient where the light from a large window will be reflected from the surface of the cornea, such a reflex showing all the irregularities of the reflecting surface. To make sure that these irregularities are not filled in with mucus, that may render them invisible, it is well to wipe the surface with a pledget of cotton. Or to outline an ulcer more distinctly for treatment, it may be stained with a solution of fluorescein, 1 part; sodium bicarbonate, 2 parts; distilled water, 200 parts; or with one of toluidin-blue 1 to 1000.

Series of cases in which tuberculin was used for diagnostic purposes. In hereditary syphilis without any signs of tuberculosis the writer has never observed the slightest reaction; while, on the contrary, when tuberculosis was present, whether syphilis was also present or not, the reaction has always occurred. A local reaction cannot be expected in these cases, and a general reaction is the only one that is of value. Enslin (*Deutsche med. Wochen.*, Feb. 26, 1903).

CONJUNCTIVITIS.—Keratitis must be distinguished from conjunctivitis. Lesions of the cornea are the most common and the most dreaded complications of conjunctival inflammation. But more especially on that account is it necessary to recognize promptly when the cornea

becomes involved. The treatment required by keratitis is, too, in many respects totally different from that appropriate to conjunctivitis. Unless the cornea itself exhibits the characteristic opacity or loss of substance, we cannot assume that it is affected. The redness of the pericorneal zone, while quite different from the typical redness of conjunctivitis, may be completely hidden by swelling of the conjunctiva.

IRITIS.—The differential diagnosis between keratitis and iritis is also very important. Here, too, the detection of the actual lesions present in one or the other of these structures is to be relied on. Corneal disease may cause apparent discoloration of the iris; and in the early stage of keratitis the pupil is apt to be very small. But the use of a mydriatic (which would generally be very appropriate for either disease) will, in keratitis, produce regular dilatation of the pupil, even if it is not as wide as in the normal eye.

An error, much more grave, is to mistake *inflammatory glaucoma* for keratitis. Both diseases may present pericorneal redness, pain, photophobia, and haziness of the cornea; and glaucoma shows impairment of the sense of touch in the cornea, as markedly as does neuropathic keratitis. In the latter disease the tension of the eyeball may be diminished; in glaucoma simulating keratitis it is always increased. The pupil in glaucoma is more or less dilated; in keratitis, unless a mydriatic has been used, it is contracted or normal. The haziness of the cornea is more uniform and diffuse in glaucoma, while in keratitis it is more likely to be localized. Corneal ulcer may occur in glaucoma, but usually only in chronic cases. The chief pain of glaucoma is of an aching character, and is felt as much in the brow and cheek as

in the eyeball. That of keratitis is more likely to be smarting or burning, or the sense of a foreign body. If a mydriatic has been used and the pupil has been dilated, the tension of the eyeball and the ophthalmoscopic symptoms must be relied on. Haziness of the cornea, sufficient to prevent an ophthalmoscopical diagnosis, is not likely to occur in glaucoma, except when the increase of tension is so great as to be quite unmistakable.

DIAGNOSIS OF VARIOUS FORMS OF KERATITIS.—The diagnosis of the particular form of keratitis present is often very important. Here the character of the opacity or ulceration may be of great significance. Interstitial keratitis will be known by the depth of the opacity, the fine loops of the vessels, the involvement of the iris, and the other evidences of constitutional taint. The history of a nerve-lesion or the loss of sensibility in the cornea point to neuropathic keratitis. In the malarial form there is obtainable a history of malaria, and the linear ulcers are in tissue having less than normal sensibility to touch. In dendritic keratitis these features are absent. Herpetic keratitis is characterized by the minuteness of the scattered ulcers and the history of previous illness; and punctate by the points of chief opacity. Bullous keratitis is known by the burning pain, followed by the large bleb or superficial abrasion. Pannus is readily recognized by the distribution of the vessels and the superficial opacity; and the evidence or history of preceding conjunctival disease. Traumatic and striate keratitis will give the history of injury. The suppurative ulcer will be recognized by the yellowish infiltration of the part of the cornea into which it is extending.

Etiology and Pathology.—The dominant facts in the pathology of corneal

ulcer are that the cornea is a tissue closely related to the white, fibrous connective tissue of other parts, that it is non-vascular, that it is peculiarly predisposed to injury and infection, and that it is covered by epithelium liable to the same injurious influences as the epithelium of the conjunctiva. The tendency of the principle corneal tissue is shown in the controlling influence of the constitutional causes of interstitial keratitis and the prolonged stage of resolution in all forms of inflammation involving the true corneal substance.

The absence of blood-vessels is responsible for the frequent occurrence and disastrous extension of ulcerations, and the danger of the spread of whatever infection may occur. The extension of conjunctival infections of various kinds to the cornea is what might be expected from the similarity of their epithelial coverings.

In pathological examination of 11 cases of purulent keratitis in the human subject, 5 of which were examples of *ulcus corneæ serpens*, 4 of *keratomalacia*, and 2 of beginning *panophthalmitis*, it was found that Descemet's membrane remained intact unless there was a complete perforation of the cornea, although at times the endothelial cells upon the posterior surface of this membrane were absent in many places. In these cases the corneal parenchyma was found to be oedematous, the corneal spaces being enlarged and filled with altered corneal cells and leucocytes with numerous nuclei. In several instances there was a distinct exudation of fibrin between the lamellæ of the cornea, especially, however, near the ulcer. The leucocytes invaded the membrane from the limbus and mainly in the superficial layers. In the cases of *keratomalacia* only the lower third of the cornea showed inflammatory change. In the ordinary forms of ulceration Bowman's membrane and the corneal epithelium were absent from about the ulcer. In the later stages of *ulcus corneæ serpens* the epithelial cells were greatly in-

creased, being absent only from near the ulcers. The authors believe that *hypopyon* is formed from the iris and from the surrounding spaces of Fontana and Schlemm's canal. In the cases of *panophthalmitis* the inflammation had extended rapidly through the retina. Uthoff and Axenfeld (*Archiv f. Ophthal.*, B. 42, Ab. I).

Trophoneurotic keratitis differs in its pathology from *keratitis e lagophthalmo* in that in the latter condition the lesion of the cornea is the result of exposure from an uncovered cornea, together with general loss of resistance on part of all the tissues. In trophoneurotic keratitis the lesion is found under the covered cornea. K. K. Wheelock (*Ophthalmic Rec.*, Feb., '98).

Traumatism and infection play a part probably in all forms of ulcerative keratitis. Germs are always present in the conjunctiva and atmosphere. So that in the absence of resisting power on the part of the tissues every wound becomes infected. When, however, the germs are markedly pathogenic, as in the conjunctivitis which attends chronic lacrymal obstruction, or in that due to acute infection of the conjunctiva, the corneal lesion proves more serious. Swelling of the conjunctiva around the corneal margin, chemosis, prevents the lids from cleansing the cornea, and produces a sulcus, in which the infected discharges tend to accumulate. It is in this way that chemosis causes corneal involvement in gonorrhœal conjunctivitis. The peculiar forms of different ulcers and the way they extend are largely dependent on peculiarities in the growth of the organisms that cause them. Thus, the serpent ulcer, with its rapid extension laterally and its abrupt or overhanging margin, is probably due to the growth of the pneumococcus, which tends to spread between the layers of the cornea without penetrating them. Dendritic ulcer is probably also due to infection. Bullous

keratitis may arise from obstruction in the lymph-channels in the part. Pannus is due to traumatism by the roughened lids, probably with an added specific irritant. Xerotic keratitis may be infective, although the so-called xerosis bacillus is found abundantly in the normal conjunctiva.

Summary given of 130 cases of keratitis interstitialis diffusa, including 5 cases of keratitis interstitialis annularis. In the 5 cases of the annular form of the disease 4 were over 20 years of age. Its etiology remains unexplained. In 125 cases of the diffuse form hereditary syphilis could be positively determined in only 40 instances. Pfister (*Cursalon Zeit. f. Balneol.*, Mar., '90).

Among 15,000 patients only 42 cases of interstitial keratitis were found; of this number 16 were males and 26 females. As a rule, the affection was bilateral, in only 9 cases occurring on one side. The average age of development was 13½ years, the earliest being 3 months and the latest 30 years. The complications of most frequent occurrence were affections of the tractus uvealis, and especially iritis; in all, characteristic teeth were found in 40 per cent. In more than half the cases hereditary syphilis could be proved (55 per cent.). Werndly ("Keratitis Diffusa," '91).

Two cases of keratitis, 1 of them complicated with iritis, occurring in women of advancing age suffering from malignant uterine disease. The ocular trouble believed to have been caused by infectious emboli. Du Bois-Reymond (*Zehender's klin. Monats. f. Augenh.*, Apr., '91).

Case of periodically-occurring attacks of keratitis, apparently depending upon menstrual disorder and chlorosis. Usually both eyes were affected, the attacks beginning after the appearance of the flow and lasting a few days longer. In the intervals the eyes were well and the vision good. Ransohoff (*Zehender's klin. Monats. f. Augenh.*, Aug., '91).

In the exudate of scrofulous keratitis was found a coccus colored by Gram's method, liquefying in gelatin and producing keratitis in rabbits, which was be-

lieved to be *staphylococcus pyogenes*. Straub (*La Sem. Méd.*, May 25, '92).

Clinical, anatomical, and experimental facts point to interstitial keratitis even when it is clinically a primary manifestation, being either a symptom of an existing or a consequence of a previous morbid process in the uveal tract. What may be called clinically primary interstitial keratitis appears to have no uniform etiology. Hereditary syphilis is the most important and most frequent cause; local conditions may, however, influence the proportion in which this cause preponderates. Against the exclusive importance of syphilis may be mentioned:—

The absence of other indications of hereditary or acquired syphilis in 30 per cent. to 50 per cent. of the cases.

The occurrence of interstitial keratitis in animals.

The anatomical demonstration that the condition may sometimes depend upon a tubercular infection of the eye.

The fact that diseases of the uveal tract may be due to various causes.

Individuals who have never acquired syphilis may suffer in advanced life from interstitial keratitis.

Hutchinson's teeth do not appear to occur in the majority of cases; their presence points to the probable, though not the certain, existence of hereditary syphilis.

Recurrences of interstitial keratitis are not uncommon. E. v. Hippel (*Graefe's Archiv*, xlii, 2).

Dendritic keratitis considered an herpetic disease of the cornea due to constitutional causes, malarial poisoning being very prominent. Wilder (*Med. News*, July 15, '93).

Of 25 cases of hypopyon keratitis, the diplococcus was found in 23, either alone or associated with a staphylococcus. In 4 cases the micrococcus occurred in phlegmonous disease of the eye. Guaita (*Recueil d'Ophtal.*, June, '94).

In the majority of instances of hypopyon keratitis the infectious agent is the diplococcus of Fränkel. In nearly all personal cases the germ was found in the mouth, giving rise to the suspicion of disease in that cavity. Bassa (*Recueil d'Ophtal.*, June, '94).

Interesting case of parenchymatous clouding of the cornea following lighting-stroke in a girl 11 years old. There was present almost complete amblyopia and marked blepharospasm. After 18 days the cornea cleared spontaneously, and the patient regained full visual acuity. Denig (*Münch. med. Woch.*, Aug. 20, '95).

As a result of bacterial study of fifty cases of suppurative keratitis, it is concluded that the pneumococcus is invariably the exciting agent in hypopyon keratitis. The lacrymal and nasal passages abound with this particular organism. Uhthoff and Axenfeld (*Berliner klin. Woch.*, Nov. 25, '95).

From a clinical study of interstitial keratitis it is considered that in the majority of cases this affection of the deeper layers of the cornea is secondary to inflammation of the anterior part of the uveal tract; also that it is due to congenital syphilis. Cook (*Jour. Amer. Med. Assoc.*, Mar. 7, '96).

No specimen ever seen that would tend to show that pus-cells ever do or can pass through Descemet's membrane into the anterior chamber; their only way lies through the meshes of the ligamentum pectinatum. Alt (*Amer. Jour. Ophth.*, May-June, '96).

Ocular lesions due to obstetrical interference are uncommon. Case of keratitis observed in the newborn which seems to have resulted from a prolonged application of the forceps. The left eye alone was affected, and its appearance suggested a purulent ophthalmia; but the eyelids were more markedly swelled than is the case in commencing ophthalmia, and there was scarcely any discharge. On separating the eyelids it was seen that practically the whole cornea was cloudy, and there was intense conjunctival hyperæmia. The treatment consisted in the application of ice, atropine, and boric lotions. Dujardin (*Jour. des Sci. Méd. de Lille*, Nov. 28, '96).

The etiology of interstitial keratitis is not well defined, but hereditary syphilis is undoubtedly the usual origin. Von Hippel (*Arch. f. Ophth.*, vol. xlii, pt. 2, '96).

The most various infectious diseases,

nutritional derangements, etc., may cause an interstitial keratitis. Among such causes by far the most frequent is hereditary syphilis; then comes tuberculosis, acquired syphilis, influenza, malaria, diabetes, etc. A. Greeff (*Sammlung Zwangloser Abhand. aus dem Geb. der Augenh.*, '97).

Case of relapsing interstitial keratitis of uterine origin. A young woman aged 25 years, for a period of eighteen months has had at each menstrual epoch visual troubles pertaining mostly to one eye, and marked by the appearance of white spots of infiltration in the cornea. The ocular trouble came on eight days before the appearance of the menses, and disappeared on their cessation. On one or two occasions almost the whole cornea was affected, and there was intense pericorneal injection and photophobia, persisting for a month. The patient was of a scrofulous disposition. Vaginal injections and attention to hygienic measures sufficed to disperse the ocular attacks, and the corneæ have regained their transparency. Kœnig (*Soc. Franc. d'Ophthal.*, May, '97).

Horner's conception of the relation between eczematous eruptions of the skin and the anterior nares and the phlyctenular diseases of childhood is not always apparent, but nearly constant. The conditions that predispose to these local disturbances are essentially constitutional and no local treatment is in any large proportion of cases to be regarded with favor. On the other hand, constitutional measures are of the first importance and may alone be relied upon even in complicated cases, so far as the eye is concerned as a participating organ. D. S. Reynolds (*Phila. Med. Jour.*, July 16, '98).

Prognosis. — Interstitial keratitis is always slow. In rare cases it may run its course in one or two months; quite as frequently it will require that many years. Until it has fairly begun to subside no one can tell how severe or how protracted the attack will be. If seen early it is pretty safe to predict that the eyes will get worse in spite of all treat-

ment before they will begin to get better. If seen at the height of the attack great improvement may be promised, continuing over a long period. Useful vision will probably be restored even when everything but light-perception has been lost. But complete recovery with normal vision rarely, if ever, occurs. If the opacity is most marked at the centre of the cornea and many fine vascular loops are seen which extend but a little way on the cornea, the disease is still in an early stage. If the vessels are rather sparsely diffused throughout the cornea, and the opacity chiefly confined to the central region, it is probable that the periphery of the cornea has already cleared, and that the most rapid improvement of vision is about to take place.

For the rarer forms of neuropathic and malarial keratitis the prognosis must depend considerably upon the general condition of the patient. There is some danger of relapses; and it must not be forgotten that ulcers from this disease are liable to infection, with all the consequences thereof. At the best they are likely to leave the affected portion of the cornea nebulous and irregularly astigmatic. Herpetic ulcers, unless greatly neglected, commonly leave no trace. Punctate keratitis usually leaves the cornea slightly damaged; and the syphilitic form is very chronic, with quite incomplete resolution.

Phlyctenular keratitis, if carefully treated, commonly leaves very little permanent damage of the cornea. But, occurring in the children of the ignorant and careless, it is very often neglected; so that a large proportion of the nebulous corneas with high, irregular astigmatism are due to it. It is extremely liable to relapse; but the single attack yields promptly to treatment, or terminates often within two or three weeks in spon-

taneous recovery. The tendency to recur is the serious feature of bullous keratitis. But permanent complete recovery may occur in the cases due to traumatism.

Pannus rarely ends in complete recovery. It depends largely on the condition of the lids. If these can be rendered smooth and do not press upon and rub the cornea, it will get comparatively clear, and free from vessels. But some irregular astigmatism always remains. Fortunately the disease does not usually involve the part of the cornea in front of the pupil; so that normal vision may be retained. Striate keratitis usually clears up entirely in a few days or a few weeks. In other forms of traumatic keratitis the prognosis depends on the situation and extent of the loss of substance.

In suppurative keratitis there is always more or less permanent opacity; which is of serious or slight importance according to its situation. The density of the opacity is somewhat proportioned to the depth of the ulcer causing it. The danger of extension in an infected ulcer is indicated by infiltration of its margins or base; that is, by the extent to which the process is invading new tissue. When this extension ceases, when the ulcer becomes "clean," improvement is to be expected. Ulceration is particularly dangerous to the cornea, because it is non-vascular; and when, in the course of an ulcerative keratitis, vessels extend out from the limbus, and invade the floor of the ulcer or the tissue immediately around it, the danger of perforation passes away. Perforation, with prolapse of the iris into the opening, always causes a permanent leucoma, which is serious according to its size and location (see CORNEA, OPACITIES OF, volume ii). Suppurative disease of the cornea is often

the starting-point of an infection that ends in panophthalmitis, or a slower inflammation of the uveal tract, and chronic degenerative changes. And perforating ulcer may ultimately cause sympathetic disease of the other eye.

Treatment.—While the removal or treatment of the special causes varies with the different forms of keratitis, certain general principles are applicable to the treatment of all kinds of corneal inflammation. In the first place, the general health of the subject has much to do with the resisting power of the cornea, and should be guarded and built up in every way. This does not mean that stimulants should be used in the majority of cases. But it does mean that the patient should have sufficient nourishing food, fresh air, enough exercise to keep the circulation and respiration active, sunlight and the influences of cheerful surroundings, and plenty of sleep. To secure sleep it may be necessary to give analgesics; but these should be given in small doses, and only to supplement the influence of fresh air and exercise. It may be well to give a laxative, when needed to promote digestion; but active purgation should be avoided. Tonics may be indicated, and full doses of tincture of the chloride of iron seem to have a distinct influence in checking suppuration.

Local measures must be such as to support, not impair, the vitality of the part. On this account cold applications must be avoided, even where they would be indicated if it were not for the corneal lesion. On the other hand, anything that will keep the eye continuously warm and moist, acting like a poultice, is liable to be injurious. Applications of hot fomentations for a few minutes at a time, or the more continuous application of dry heat, may be beneficial. The

danger of its poulticing effect should generally exclude the bandage; but under certain circumstances it may be best to use it. These are: in neuropathic keratitis when the slight traumatism to which the cornea is exposed when the eye is open decidedly aggravate the trouble, and when there has been an injury causing a clean loss of the corneal substance,—an uninfected ulcer. The eye should be kept closed, in any case of corneal ulcer, when exposed to dust that would be likely to lodge in the cavity or be pushed into it by the normal movements of the lids.

Simple method for the treatment of grave ulcers of the cornea complicated with hypopyon. After washing the conjunctival sac with a 1-to-5000 sublimate solution, the closed lids are covered with a thick compress of salolized gauze, antiseptic cotton, and, finally, a damp tarlatan bandage, which, in drying, forms an immobile dressing and secures equal compression. This dressing is renewed every three or four days, till cure is effected. Very satisfactory results claimed. The same success is achieved in simple ulcers without hypopyon, in scrofulous ulcers of children, and in all ulcerative keratites. Valude (*La Sem. Méd.*, Feb. 11, '91).

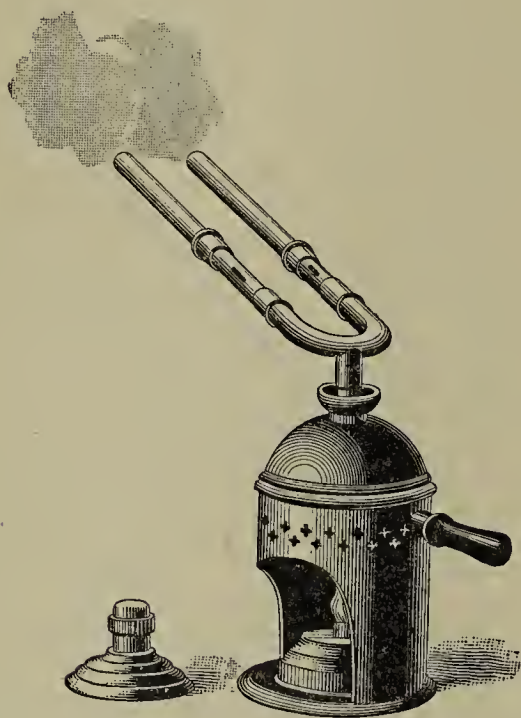
In the treatment of corneal inflammations and opacities hot boric-acid compresses and calomel insufflations found most efficacious. Chauvel (*Rec. d'Oph.*, Oct., '92).

In the treatment of keratitis neuro-paralytica the chief indication is protection to the eye by occlusive dry dressing, and the application of vaselin and iodoform, while, in general, treatment should be directed to the underlying cause. Panas (*Recueil d'Ophthal.*, Nov., '92).

Chloride of sodium in the strength of 4 to 1000 and the application of a bandage are the best means of combating keratomalacia. Berger (*Revue Gén. d'Ophthal.*, May, '94).

Local treatment of interstitial keratitis consists in keeping the pupil dilated with atropine, and the use of warm compresses or frequent warm bathing of the

eyes during the active inflammatory stages, with moderate, not excessive, protection of the eyes from light; and, for the residual opacities after the acute stage has subsided, massage with a mercurial or iodide-of-potash ointment (10 to 20 per cent. of the yellow oxide of mercury, or 10 per cent. of iodide of potash), the massage being done by rubbing the cornea strongly with the finger through the closed lids twice a day for five to ten minutes, a drop of cocaine solution being previously instilled if the patient is sensitive. In the constitutional treatment no means are to be neglected which



Steam-generator for inflammation, ulceration, and opacity of the cornea. (*Bissell.*)

may improve the condition of the patient's general health, and, secondly, where syphilis is present, the special indications are threefold, viz.: mercury, sweating, and iodide of potash. Decided preference given to the inunction method. As a sequel to the mercurial treatment it is distinctly advantageous to give the patient a course of iodide of potash: 30 grains of the salt are given per day, until he has taken 25 to 40 drachms. R. Greeff (*Sammlung Zwangloser Abhand. aus dem Geb. der Augenh.*, '97).

Apparatus for applying steam in eye-work. It is arranged so that either one or both eyes can be steamed at the same

time. The chief essential is that it be so constructed as to prevent the patient being burned by the steam. This is here accomplished by a diaphragm with only one-half millimetre perforation placed about halfway in each projecting arm. Just beyond this small perforation there is a larger external one, which permits the air to mix with the steam before it escapes from the end of the tube. The treatment is begun by placing the eyes of the patient about six inches from the opening and gradually having him approach to within three inches; by so doing the temperature of the steam when it reaches the eyes increases from 100° F. to 112° F. The steaming is continued from ten to twenty minutes. In this way it has been used in a large number of cases of inflammation, ulceration, and opacity of the cornea, with very gratifying results. After the steaming process, yellow-oxide-of-mercury cerate, calomel powder, resorcin, or whatever agent seems indicated, is placed on the cornea, and gentle massage made over the closed lids. Elmer J. Bissell (*Jour. of Ophthal., Otol., and Laryng.*, Oct., '98).

Success in treating superficial infiltrations of cornea with small ulcers by means of applications consisting of an ointment composed of 0.10 gramme ($1\frac{1}{2}$ grains) of ichthyol and 0.15 gramme ($2\frac{1}{4}$ grains) of cocaine, in 5 grammes ($1\frac{1}{4}$ drachms) of excipient. Under the influence of these applications the signs of inflammation rapidly decrease and the pains disappear. The newly formed blood-vessels, so common in this disease, also fade away. The tissue of the cornea regenerates, and, as a rule, only a small portion of the opacity remains. The record of the author's cases now reaches 28, of which 22 were either trachomatous or blennorrhagic. I. I. Federov (*Semaine Médicale*, Sept. 24, 1902).

In all corneal inflammations cleanliness or asepsis is of the highest importance. This is to be secured by douchings of the conjunctival sac, and the wiping away of discharges when this is necessary. If there is no conjunctival discharge washing out the eye once or twice a day

may be sufficient. If there is profuse discharge, cleansing the eye every hour may be necessary. The solutions employed should never be irritant, the 2-per-cent. boric-acid solution, or the normal salt solution (3 grains to the fluid-ounce) are the best. They should be applied at blood-heat or a little warmer. To wipe away any masses of discharge that accumulate, swabs of absorbent cotton moistened with the cleansing fluid, to prevent the cotton from sticking to the eye, may be used.

A 4-per-cent. solution of common salt, used subconjunctively, found quite as effective as the different solutions of corrosive sublimate in the treatment of corneal ulcers. Wood White (Birmingham Med. Rev., Jan., '96).

Formalin found to give excellent results in the treatment of infecting ulcers of the cornea and in purulent conjunctivitis. The strength to be employed as a collyrium is from 1-1000 to 1-2000. Burnett (Ophthalmic Record, March, '96).

The best treatment for corneal ulceration due to nasal infection: The nose should have antiseptic irrigation and local treatment applied. The lacrymo-nasal duct should be disinfected or dilated. The eye should have a soothing lotion, a mydriatic instilled, and a cauterant applied to the ulcer if necessary. The diet should be regulated, tonic and antiphlogistic treatment given, and the hygiene generally improved. Ziegler (American Medicine, Apr. 9, 1904).

The pain of keratitis is commonly lessened by instillations of atropine or other mydriatics. It may also be mitigated by brief applications of very hot water to the eye, or the internal use of acetanilid, morphia, or codeia in small doses. It is temporarily relieved by cocaine. But this should never be prescribed, because the after-effects are altogether bad; and the temporary relief it affords tempts the patient to frequently repeat the applications, each of which

aggravates the disease. The new local anæsthetic, holocaine, is less likely to be harmful when used in this way, and it has a decidedly antiseptic action; but whether it is entirely safe is yet to be determined. The best cure for pain is, in general, the cure of the condition causing it. It is in this way that physostigmine (eserine) quickly relieves the chronic very painful shallow ulcers that occur at the margin of the cornea in elderly people, with chronic catarrhal conjunctivitis. Photophobia may be lessened by the wearing of dark glasses and the avoidance of sudden changes to a bright light. But it grows rapidly worse if the patient be confined to a dark room; and the confinement is likely to react unfavorably on his general physical condition. Of course, during an active keratitis the eyes should, as far as possible, be allowed to rest.

For the cure of hypopyon keratitis the instillation of a solution of sulphate of eserine, 2 grains to 1 ounce, and the constant application of a bandage, together with general tonic treatment highly recommended. Manche (Brit. Med. Jour., Jan. 17, '91).

In a case of recurrent keratitis superficialis punctata the use of cocaine caused an increase in the severity and duration of the attack. Bronner (Brit. Med. Jour., June 18, '92).

New treatment of hypopyon which consists in dropping into the eye a 4-grain solution of atropine once every other day or second day, and a casual bathing of the eye with hot water or a little boric acid, combined with the administration of mercury and potassium iodide taken internally, and pilocarpine, given hypodermically. The treatment has given excellent results and has several special features—the rapid relief of pain, the cure of the diseased condition with at least as great or greater certainty than by other methods, the gradual and uniform removal of the corneal opacity, and the absence of any

pain immediately associated with this form of treatment. G. H. Burnham (Lancet, Dec. 6, 1902).

SPECIAL TREATMENT. — Interstitial keratitis especially requires the employment of mydriatics on account of the tendency to involvement of the iris. Atropine may be used in solution of: atropine sulphate, 1; distilled water, 60. The frequency and freedom of its applications may be limited by the tendency to cause mydriatic intoxication. When sufficient to keep the pupil well dilated, the strength of the solution and the frequency of its application may be diminished. Locally, hot fomentations, and sometimes local bleeding from the temple, may also be employed. But the curative treatment is probably chiefly constitutional: first, the preservation of the general health; and, after that, the prolonged administration of mercury and the iodides in moderate doses. Codliver-oil, iron, and arsenic are sometimes most beneficial.

For neuropathic, malarial, and herpetic keratitis, the general and tonic treatment is of most importance, with careful protection of the eyes from irritants.

The treatment recommended to prevent keratitis after destruction or removal of the Gasserian ganglion is: Stitching the lids together for the first few days, and, after the removal of the dressings keeping the eye covered with a Buller shield for a month. For punctate keratitis atropine should be applied. Bullous keratitis may be met with atropine and hot applications during the attack; and regular massage with some mild ointment during the intervals. It may also become an indication for the enucleation of a degenerated eye.

Dendritic ulcer should be scraped and touched with a solution of silver nitrate

or formaldehyde of a strength of 1 to 60. Phlyctenular keratitis was long known as the common form of scrofulous ophthalmia, and must be treated with especial reference to the general conditions that accompany it. Out-door life; plain, readily digested food; and the avoidance of sweets, tea, and coffee must be insisted on. Codliver-oil and syrup of iodide of iron are standard remedies. The child must not be allowed to keep the eye buried in the pillow or handkerchief; but should be encouraged to overcome photophobia by exposure to the light and air. Local treatment is also very important. Photophobia will be diminished by the instillation of atropine. The ointment of: yellow oxide of mercury, 1 part; petrolatum, 60; should be used in the conjunctival sac every night. The lower lid being drawn down, a piece of the ointment the size of a grain of rice is placed on its inner surface, and the lids are closed and then rubbed gently over the eyeball for a minute or two. If there is much redness of the ocular conjunctiva or enlargement of the veins on the inner surface of the lids, tannin, 1; glycerin, 60; should be applied to the everted lids every day or two. Treatment should be continued many weeks after an attack to prevent recurrences. A most important measure for the same purpose is the thorough eradication of all morbid conditions discoverable in the nose.

Iron, the remedy most commonly prescribed in the phlyctenular keratitis of children, is frequently injurious. The extreme irritability of the eyes is aggravated by its use in the early stages, while it is useful enough at a later period. In the early stages it is far better to employ mercury internally. This may be advantageously exhibited in the following combination from the Moorfields "Pharmacopœia"; Gray powder, 1 grain (0.06 gramme); powdered

belladonna leaves, $\frac{1}{2}$ grain (0.03 gramme); sugar of milk, 1 grain (0.06 gramme). One powder twice daily.

Atropine locally is essential with frequent bathing in boric lotion. Later, but not in the acute stage, an ointment of the yellow oxide of mercury, 2 to 8 grains to the ounce, is useful. At this stage iron is indicated.

For the photophobia all sorts of measures have been recommended—blisters, setons, insufflations of calomel or powdered glass (!), and holding the child's head under water. None of these are to be thought of. The development of fissures and excoriations at the outer canthi is one of the chief causes of the photophobia, cure of which is half the battle. The best treatment is stretching the fissures so as to make them bleed, preferably under an anæsthetic. At the same time they may be painted with a solution of nitrate of silver, 5 to 10 grains to the ounce. Cocaine, though it may be of great use in aiding the surgeon to make a thorough examination, should never be given to the patient; neither should alum or sulphate of zinc. All three of these agents tend to destroy the epithelium and favor perforation. Marshall (*Practitioner*, Jan., 1903).

Pannus requires the thorough treatment of the morbid conditions of the lids which cause it, sometimes including canthoplasty, or other operations on the lids to relieve the cornea from abnormal pressure. Other special measures for the treatment of opacity are mentioned in volume ii.

In oyster-shucker's keratitis the yellow salve has proved useless. A compress bandage and a mild sublimate solution (1 to 4000) used every four hours, together with an occasional drop of a solution of atropia—1 per cent.—have given the best results. To this treatment the keratitis responds promptly, and in a week or ten days the subjective phenomena have been so ameliorated that the shucker can resume work. The opacity can be detected by oblique illumination, and is permanent. R. L. Ran-

dolph (*Johns Hopkins Hosp. Bull.*, Nov., Dec., '95).

Suppurative keratitis requires the prompt and thorough removal of infective discharges and infected tissue so far as possible. Corneal abscess should be freely opened as soon as it is recognized. For infected ulcers the simplest and most generally applicable treatment is scraping or curetting. The tissue around the ulcer should be thoroughly and repeatedly scraped toward the ulcer so as to empty the interlamellar spaces of their contents; and all softened tissue should be removed. After scraping, the ulcer should be closely watched; and upon any evidence of farther extension of the infective process thoroughly scraped again.

Equally as efficient as scraping, though a little more alarming to the patient, is the application of the actual cautery. This application may be made with the galvanocautery tip; or with a piece of steel knitting-needle, one end of which is held in an alcohol-flame until white hot, and then quickly applied to the affected portions of the cornea. The cauterization should include all infected parts of the tissue. After cauterization the eye may remain undisturbed for a day or more except that it must be kept cleansed.

Two cases of traumatic keratitis successfully treated, after they had resisted other measures, by cauterizing the ulcer with pure carbolic acid. A. D. Williams (*St. Louis Med. and Surg. Jour.*, Jan., '90).

In the treatment of infectious ulcers of the cornea, excellent results obtained from touching the ulcer once or twice daily with tincture of iodine. The advantages claimed are the prevention of staphyloma and the formation of corneal cicatrices less opaque than those resulting from other methods of treatment. Chibret (*Recueil d'Ophthal.*, Sept., '91).

Scraping and cauterizing the diseased tissue instantly relieves the pain and photophobia in ulcerative keratitis. The new tissue is more transparent than that which follows any other mode of treatment. De Wecker (*Ann. d'Ocul.*, July, '93).

The actual cautery considered applicable especially to sloughing ulcers, to ulcers in which the spread of local infection is the dominant symptom, to ulcers which decline to heal under moderate means. De Schweinitz (*Amer. Jour. of Ophthal.*, Apr., '91).

A powerful agency for draining the affected tissue, and establishing lymph-currents that shall check the progress of infection, is the Saemisch incision, made by thrusting a narrow cataract-knife beneath the ulcer and letting it cut directly out dividing all the affected tissues and permitting the free drainage of fluid from the anterior chamber.

In cases of hypopyon from traumatic ulcer the instillation of a drop of a weak solution of sulphate of quinine and atropine, every two or three hours, rarely fails to cause absorption, if the case be seen before the pus has become thick and glutinous. R. Williams (*Liverpool Medico-Chir. Jour.*, July, '91).

In case of extensive ulceration of the cornea and conjunctiva, adhesion prevented by the employment of an eye-shell made of vulcanized rubber. Searles (*Amer. Jour. of Ophthal.*, June, '93).

In ulcer cornea serpens any procedure that induces long-continued abolition of the anterior chamber may induce glaucoma, and is, therefore, to be rejected. Sachsaler (*Beit. z. Augenh.*, Feb., '96).

Thioform found better than iodoform, boric acid, and all other dry applications in ulcer of the cornea. Rogman (*Ann. d'Ocul.*, Mar., '96).

Methyl-violet and subconjunctival injections recommended in corneal ulcers. Darier (*Rec. d'Ophtal.*, Mar., '96).

In keratitis personal treatment is to apply to the floor of the corneal ulcer silver nitrate in 30-grain solution. Woods (*Presb. Hosp. Rep.*, Jan., '93).

Excellent results obtained in the treat-

ment of hypopyon keratitis by subconjunctival injections of corrosive sublimate (1 to 1000). Niklikin (*Vestnik of Ophthal.*, July-Oct., '96).

Subconjunctival injections of mercury used in infectious keratitis associated with hypopyon in eighteen cases. The writer prefers a solution of the cyanide, 1 to 100, and injects as much as 5 centigrammes. Fromaget (*Ann. d'Ocul.*, Apr., '96).

The treatment of filamentous keratitis consists in abrasion of the filament, at the surface of the cornea, and the employment of a collyrium of methyl-violet 1 to 10,000. Sourdille (*Le Prog. Méd.*, Apr. 4, '96).

Hypodermic injections of iodine successfully employed in cases of parenchymatous keratitis. Lodato (*Vestnik of Ophthal.*, May, June, '97).

The acrid expressed juice of the bitter cassava is a useful remedy in the treatment of corneal ulcers. S. D. Risley (*Archives of Ophth.*, July, '98).

Case of ulceration of the cornea of two years' duration treated by exclusion of actinic light. The patient had intense intolerance of light, and was confined to a darkened room. Every form of treatment was tried without avail, until, acting on the theory that the actinic rays were keeping up the trouble, the patient was placed in a room the windows of which were covered with red photographic tissue paper. The effect was most remarkable. The intolerance to light and pain disappeared, while the injected cornea blanched as if adrenalin had been applied. The next morning lachrymation and discharge ceased, and on the third day the patient could read and sew. No sign of ulceration could be seen. The next day she went out of doors protected with ruby glass goggles. The red rays may have some germicidal action, or they may act by allaying inflammation. W. Lowe (*Intercolonial Med. Jour. of Austr.*, Mar. 20, 1903).

EDWARD JACKSON,
Denver.

KIDNEYS, DISEASES OF. See
URINARY SYSTEM.

KIDNEYS, INJURIES OF. See ABDOMINAL INJURIES.

KINO.—Kino is the inspissated juice of *Pterocarpus marsupium*, a leguminous tree of the East Indies and Malabar. It is obtained from incisions into the trunk, and is dried without artificial heat. It occurs in fragments of a ruby-red color, without odor, and of a sweetish, astringent taste. It is soluble in alcohol, ether, boiling water, and alkalies, but only slightly soluble in cold water. Its most important constituent is kinotannic acid. It also contains kinoin, a crystalline neutral substance; pyrocatechin, pectin, etc. Kino is an ingredient of the pulvis kino compositus (B. P.) and also of the pulvis catechu compositus (B. P.).

Preparations and Doses.—Kino, 5 to 30 grains.

Tinctura kino, $\frac{1}{2}$ to 2 fluidrachms.

Physiological Action.—The physiological action of kino may be said to be that of its main constituents, kinotannic and gallic acids, especially the former. It is an astringent and styptic, preserving its activity in these particulars throughout the entire length of the intestinal tract. Its value in arresting intestinal hæmorrhage is thus accounted for.

Therapeutics.—Kino is a mild astringent. It is useful in serous diarrhœa, for which purpose it is generally combined with paregoric and chalk mixture, or exhibited in the form of compound powder of kino (B. P.), which consists of kino, 15 grains; powdered cinnamon, 4 grains; opium, 1 grain. Five to 20 grains are given as a dose. Kino is a serviceable remedy in pyrosis.

Locally and internally kino possesses some value as an hæmostatic in passive hæmorrhage from the intestines and other viscera. The tincture may be used

as an astringent gargle in pharyngitis or for relaxation of the uvula. It is often an ingredient of injections in gonorrhœa and leucorrhœa. The powder may be applied as stimulating astringent dressing to chronic ulcers. In relaxed conditions of the mouth and throat and in epistaxis the tincture may be used with benefit.

KRAMERIA.—Krameria, or rhatany, is the root of *Krameria triandra* and of *Krameria ixina* (polygalæ), small shrubs growing in South America, especially in Peru and Bolivia. The bark of the root is strongly astringent in taste and almost without odor. The woody part is devoid of taste and odor and is relatively inactive. The smaller roots are therefore preferred. Krameria contains about 20 per cent. of krameria-tannic acid (the active ingredient), gum, starch, sugar, lignin, and a peculiar acid called krameric acid. An alkaloid, rathanine, has also been isolated. Krameria is an ingredient of pulvis catechu compositus (B. P.).

Preparations and Doses.—Krameria, 5 to 30 grains.

Extractum krameriæ, 5 to 20 grains.

Extractum krameriæ fluidum, $\frac{1}{4}$ to 1 fluidrachm.

Syrupus krameriæ, 2 to 6 fluidrachms.

Tinctura krameriæ, $\frac{1}{2}$ to 2 fluidrachms.

Trochisci krameriæ, 1 to 2 troches.

Physiological Action.—The krameria-tannic acid gives to krameria physiological properties very similar to those of tannic acid. It seems, however, to concentrate its effects upon the mucous membranes; hence its beneficial influence in all conditions characterized by relaxation of the latter: leucorrhœa, catarrhal disorders of the nose, pharynx, intestines, etc.

Therapeutics.—The value of *krameria* depends upon the tannic acid which it contains. It is used largely as a remedy for bowel disorders, in chronic or serous diarrhœa, in dysentery, and in passive hæmorrhage from the intestines and other viscera. In leucorrhœa and gonor-

rhœa its astringent action is valuable. Chronic pharyngitis and conditions of the respiratory mucosæ are generally benefited, but tannic acid is more convenient and effective.

KYPHOSIS. See SPINE.

L

LABIA, DISEASES OF. See VAGINA.

LABOR, ABNORMAL. See PARTURITION, ABNORMAL.

LACRYMAL APPARATUS, DISEASES OF THE.

Secretory Apparatus, Diseases of the.

DACRYOADENITIS.—Inflammation of the lacrymal gland is of rare occurrence, either in the acute or chronic form. It is indicated by swelling and œdema of the upper lid, and pain and tenderness on pressure of the gland and the adjacent supra-orbital margin. The disease may assume a purulent form, when an abscess may open, either upon the conjunctiva or through the skin.

Acute dacryoadenitis of the inferior accessory lobules, in a man 25 years of age. The disease presented itself as a small tumor under the bulbar conjunctiva, one centimetre up and out from the corneal limbus. Antonelli (*Recueil d'Ophtal.*, Aug., '94).

Rheumatism, cold, syphilis, septicæmia, and mumps have all been ascribed as the cause in various cases, while the spread of inflammation from the conjunctiva and cornea has been noted in a number of instances.

Treatment.—Hot applications and poultices in the early stages, followed by free incision under the supra-orbital region as soon as pus has formed. In the chronic variety the local application of

absorptive ointments, such as the mercurial and compound iodine, should be employed, while iodide of potassium, mercury, and the salicylates should be administered internally. In acute cases an active calomel purge should be prescribed, followed by large doses of quinine.

In acute inflammation of the gland, satisfactory results from the use of quinine, leeches, and mercurial inunctions to the brow. Chronic inflammation best treated by pressure, and the local application of iodine. Galezowski (*Recueil d'Ophtalmologie*, Oct., '92).

Case of symmetrical dacryoadenitis in which internal administration of iodide of potassium was followed by rapid subsidence of the swelling. Snell (*Lancet*, July 23, '92).

Case of non-suppurative inflammation of the lacrymal glands occurring in a negress, with a history of rheumatism. Mercuric chloride and potassium iodide, with applications of hot water to the tumors, caused cure. R. L. Randolph (*Archives of Ophthal.*, vol. xxvi, No. 1).

TUMORS.—Neoplasms, such as sarcoma and adenoma, and hypertrophy of the gland, are of rare occurrence. The latter is at times of congenital origin, but is usually an affection of later years. The gland may attain a large size, and cause serious damage to the eyeball by compression.

ATROPHY of the lacrymal gland is very rare, being usually associated with xeroma of the conjunctiva.

DACRYOPS is the name given to a cystic disturbance of one of the ducts of the gland, and occurs as a bluish-pink, translucent, elastic tissue, which is found under the conjunctiva in the position of the gland.

LACRYMAL FISTULA may form occasionally as a sequel of inflammation or traumatism of the gland, and may cause a constant discharge of tears through its orifice. A similar condition has also been observed of congenital origin.

DISLOCATION OF THE GLAND has been met with in a few instances as a result of trauma, and in a very few in which the prolapse was congenital. In other rare instances it was spontaneous in origin.

Case of traumatic prolapse of lacrymal gland in 2½-year-old-boy due to fall on sharp stones; excision; no perceptible difference in moistening of eyes or flow of tears, confirming de Wecker's theory concerning emotional lacrymation. Haltenhoff (Ann. d'Ocul., May, '95).

Case of infant who fell and ruptured the external orbital soft tissues, dislocating the lacrymal gland. The hernia was reduced and the skin sutured. The function of the organ was not disturbed. Bistis (Ann. d'Oculist., Dec., '95).

Treatment.—Extirpation of the gland is indicated in cases of neoplasms and extreme hypertrophy, or where there is obstinate stillicidium which cannot be controlled in any other way. This is accomplished by removing the gland, either directly through a skin incision made over the gland, or by an incision through the conjunctiva after exposure of the *cul-de-sac*, by division of the external canthus. The latter procedure is the one usually employed, as the ptosis which is apt to follow the first mentioned, due to injury of the levator, is avoided, and the resultant scar is much less conspicuous.

In treatment of catarrhal lacrymal obstructions with epiphora, ablation of the

palpebral portion of the lacrymal gland advised if symptoms persist after the ordinary treatment has secured a permeability of the lacrymal passages. Terson (Recueil d'Ophtal., May, '91).

In case of hernia of the lacrymal gland, produced by traumatism, protruding portion removed without interfering with the function of the gland. Panter (Omaha Clinic, June, '92).

The removal of the lacrymal gland is a procedure demanding consideration in the treatment of simple or complicated epiphora, and of those instances which resist ordinary means. It is an operation which should be held in reserve and as a last resource. Palpebral removal is an operation of choice, suitable for simple and for the majority of complicated cases; whereas orbital removal is an operation of necessity. Truc (Archives d'Ophtal., May, '93).

Three cases of tumor of the lacrymal gland. The only operative procedure indicated in the second stage of the disease is the horseshoe-incision, made sufficiently far from the orbital rim to avoid injury of the frontal nerves. Dianoux (Ann. d'Ocul., Aug., '94).

Excretory Apparatus, Diseases of the.

In contradistinction to diseases of the secretory portion of the lacrymal apparatus, diseases of the excretory portion are of very frequent occurrence and are all characterized by the common and annoying symptom of tears flowing over the cheek.

ANOMALIES OF THE PUNCTA LACRYMALIA AND OF THE CANALICULI.—*Congenital.*—Complete obliteration or absence of the puncta as well as double puncta has been occasionally observed. At times the puncta and canaliculi may be wanting, the canals being represented by narrow grooves along the edges of the lid.

Case of congenital epiphora of both canaliculi in one eye and of inferior one in other in child complaining of epiphora; hereditary origin. Lafite-Dupont. (Ann. d'Ocul., Apr., '95).

Acquired.—Such anomalies are usually the result of chronic inflammations of the lids and conjunctiva, which have disturbed the normal relationship existing between the puncta and the bulbar conjunctiva. They are frequently induced by old age, due to a senile relaxation in the orbicularis palpebrarum, and are constantly present in paralysis of the seventh nerve.

Two cases of dacryorrhœa caused by atresia of the puncta in consequence of spastic contracture of the sphincter. Seggel (*Zehender's klin. Monat. f. Augenheilk.*, Sept., '90).

Lacrymal gland supplied by the facial nerve. One-sided weeping is due to a paralysis of that nerve. The gland is only brought into activity in the act of weeping or in forced lacrymal secretion. Goldzieher (*Revue Gén. d'Ophtal.*, Jan., '94).

Secretion of tears due to the influence of a branch of the seventh pair. Triboudeau (*Jour. de Méd. de Bordeaux*, Nov. 3, '95).

Eversion of the punctum is almost a constant consequence of ectropion, and is also present in those rare cases when the eyeball is so deeply set that a triangular space intervenes between the lid and the globe.

Complete obliteration is a not infrequent result of burns and traumatism which have involved the lids, and of granular conjunctivitis and blepharitis. Rarely, the canal may be blocked by a cilium or polyp, or by leptothrix.

Cylindrical grass-blade, one-half centimetre long, extracted from the upper canaliculus of a man. Rodionoff (*Russkaia Meditzina*, No. 8, '88).

Case in which abscess of the inferior lacrymal canal was found to be caused by a piece of lettuce-leaf 2 millimetres long and 1 millimetre in circumference. The foreign body had been driven into the nose and thence into the nasal duct by repeated efforts of sneezing. Malgat (*Recueil d'Ophtal.*, Apr., '90).

Mass of actinomycoses removed from

lower canaliculus of a healthy man. Huth (*Centralb. f. prakt. Augenh.*, Apr., '94).

Symptoms.—The most common symptom of all these anomalies is the constant overflow of tears. This is annoying in itself, but, more than that, it frequently causes such irritation of the skin about the lids, that an inflammation is set up which causes contraction of the parts, and still further interference with the proper canalization of the tears.

Hyperæmia and catarrh of the conjunctiva are constantly present, consecutive to all forms of lacrymal obstructions.

Treatment.—Usually the simple dilatation of the punctum, or the slitting up of the canaliculus, is sufficient to effect a cure, with the co-operation of an astringent wash of zinc and boric acid.

In the treatment of lacrymal obstruction, the lower canaliculus is slit with a bistoury or scissors only to a distance of five millimetres from the puncta, and Bowman's sounds passed for eight days following. The triple-furrowed sound is introduced and allowed to remain in place during the remainder of the treatment, the instillation of a 1-per-cent. solution of zinc chloride being made along its capillary furrows. Libbrecht (*Recueil d'Ophtal.*, May, '91).

Lacrymal obstruction often successfully treated by slitting upper canaliculus. Story (*Ophthalmic Review*, June, '95).

Hypnotism successfully used in a number of cases to pass lacrymal probes, and even for slitting up the canaliculus without pain. A. E. Davis (*Post-graduate*, Nov., '96).

If the condition has been brought about, however, by a high degree of ectropion, or is the result of an extensive burn, relief will be frequently difficult to attain, and extensive plastic operations may be necessitated before the lid is restored to its normal position.

Anomalies of the Lacrymal Sac and Nasal Duct.

DACRYOCYSTITIS or inflammation of the lacrymal sac may be either acute or chronic.

Symptoms.—The disease is rarely acute, but begins generally as a chronic inflammation, which manifests itself by a slight swelling and redness at the inner canthus, and by persistent and troublesome lacrymation, or by the discharge of a muco-purulent secretion from the inner canthus of the eye. Pressure on the sac will express a secretion which is either mucoid or muco-purulent, either into the conjunctival *cul-de-sac* or into the nose. This condition of affairs may persist and the sac may become chronically disturbed, and give rise to a tumor of considerable size (lacrymal tumor, or mucocele). Frequently the inflammation assumes an acute form, and the region of the sac becomes swelled and reddened and a thick creamy pus forms in the sac, which is only expressed after some difficulty. The pain is intense, and there are marked constitutional symptoms, such as fever and loss of appetite. If the parts are undisturbed, the skin ulcerates and is perforated usually beneath the tendon of the orbicularis muscle, and a permanent fistula is formed. More rarely, the opening in the sac heals, and the formation of the fistula is avoided. As a result of the fistulous formation, pus frequently burrows into the deeper tissue, and necrosis of the neighboring bones is not rarely occasioned.

Under certain conditions, more especially after forcible probing, dacryocystitis may be followed by various accidents affecting the orbit of the eye itself. Such accidents are very rare. The most common is abscess of the orbit, which is followed commonly by atrophy of the optic nerve. The pallor of the disc appears with great suddenness, and the resulting atrophy is complete and incurable. Other complications are, in order of frequency: papil-

litis, which may subside completely or may be followed by atrophy; neuro-paralytic keratitis and other trophic troubles; or paralysis of some ocular muscles. The walls of the orbit may be affected, and the surrounding sinuses involved. Then the meninges may be attacked. The prognosis is always grave as regards vision, and in one case death has been recorded. Any proptosis following an operation in the lacrymal duct should arouse suspicion in the mind of the surgeon. A large opening should be made into the sac, and the sac disinfected, or, better still, destroyed with the actual cautery. Mouzels (*La Clinique Ophtol.*, Oct. 25, 1903).

Etiology.—In the great majority of cases dacryocystitis is secondary to diseases of the lacrymo-nasal duct, primary inflammation of the lacrymal sac being an extremely rare affection. It is a disease of adults, being rare in children, when it occurs under 10 years of age being usually significant of inherited syphilis.

Seven cases of so-called blennorrhœa of the lacrymal sac in newborn infants. This condition can usually be accounted for by an atresia of the nasal opening of the lacrymal canal, caused by a failure of absorption of the embryonic tissues in this position. Avoidance of sounds is recommended; slight digital pressure over the sac, combined with frequent cleaning of the eye, will work a cure in a short time. Peters (*Zehender's klin. Monats. f. Augenh.*, Nov., '91).

Fifty cases of dacryocystitis. In 24 the affection was bilateral, and there was usually an interval of several months after the time of infection. Chauvel (*Recueil d'Ophtal.*, May, '92).

Fatal case of dacryocystitis caused by injection of 3-per-cent. solution of alum acetate into the canal. Leplat (*Recueil d'Ophtal.*, Nov., '94).

Case of dacryocystitis following slitting and probing of canaliculi; total blindness. Valude (*Ann. d'Ocul.*, Mar., '95).

Nasal condition examined in 94 cases of dacryocystitis showing that 89 had

some nasal affection, whereas in only 5 was the nose healthy. E. Waggett (Ther. Monats., Dec., '96).

Examinations of the secretion from inflamed tear-sacs shows no one organism is found constantly in ordinary mucocele. Eyre (Ophth. Record, Nov., '97).

Treatment.—As inflammation of the lacrymal sac is dependent in most cases upon disease of the lacrymal duct, any obstruction existing there should be combated in the manner presently to be described. If this has been neglected, however, and an acute exacerbation has been inaugurated, hot applications should be made to the tumor, and any pus evacuated by direct incision into the sac as soon as its presence is manifested. Calomel and quinine should be administered internally. If seen early, before this procedure is rendered impossible by the swelling of the parts, an entrance should be effected into the sac by slitting up the lower canaliculus, and the abscess-cavity washed freely with a solution of bichloride of mercury (1 to 8000).

Flexible sound of whalebone employed when the sac is the seat of obstruction. Suarez (Recueil d'Ophthal., May, '90).

If pericystitis is seen in the first two or three days, before suppuration be established, it may be aborted by a single catheterization. If suppuration is established, early incision advocated. Parinaud (Ann. d'Ocul., May, June, '91).

Ten-volume peroxide of hydrogen successfully used in an 8-year-old case of lacrymal abscess with fistula. McCullough (Canada Lancet, Jan., '92).

In blennorrhœa of the lacrymal sac in newborn infants, mechanical expression of the contents of the sac is, in many cases, unnecessary. Heddaeus (Zehender's klin. Monats. f. Augenh., Mar., '92).

In lacrymal obstruction it is possible to thoroughly cleanse the lacrymal sac and to inject any desired application for the relief of inflammation of its walls through the dilated or enlarged punctum without slitting the canaliculus. Proper treatment of acute blennorrhœa of the

sac, when seen early, should consist in the use of hot compresses and antiseptic injections. If the swelling is great and suppuration threatens, an incision into the sac advised, and, after slitting the canaliculus, the passage of proper probes. Risley (Jour. Amer. Med. Assoc., Sept. 17, '92).

Sodium fluoride, 0.5-per-cent. solution, recommended in dacryocystitis. Duclos (Archives Clin. de Bordeaux, June, '95).

Ten-per-cent. solution of zinc chloride preferred as the application in dacryocystitis. Frohlich (Klin. Monatsb. für Augenh., Jan., '96).

Chronic inflammation of the lacrymal passages. The treatment should be directed (1) toward the removal of pathological processes and malformations of the nasal chamber; (2) toward the restoration of the patency of the passages; (3) toward the alleviation of all the factors conducive to the production of ocular irritation; (4) toward the proper correction of any existent dyscrasia. W. O. Nance (Jour. Amer. Med. Assoc., Oct. 27, 1900).

Stricture of the Lacrymal Duct.

Symptoms.—These are the same as in the first stages of dacryocystitis, and consist chiefly in obstinate lacrymation and in the ability to express a viscid matter into the *cul-de-sac* by pressure with the finger upon the lacrymal sac.

Stricture of the lacrymal duct is favored greatly by its relationships and by the anatomy of its parts. The mucous membrane which lines the bony walls of the canal is very vascular, and at certain parts is thrown into folds, which swell under slight provocation and offer sufficient obstacle in themselves to prevent the proper canalization of the tears. Again, the duct bears such a close relationship to the nose, that it is necessarily exposed to all inflammations of this cavity. Indeed, the great majority of cases of lacrymal obstruction are secondary to acute or chronic disease of the nose. This is particularly true of nasal disease of

syphilitic origin. As a consequence of its liability to inflammation by direct continuity of structure, the nasal end of the duct is the most frequent seat of stricture, the commencement of the duct at the extremity of the lacrymal sac offering the next most favorable site for the development of stricture.

Thirty out of thirty-five cases in which there was found, in chronic alteration of the lacrymal apparatus, an impairment of the nasal mucous membrane or a deflection of the nasal septum. Kruch (*Annali di Ottalmol.*, No. 3, '88).

Ozæna is a frequent cause of disease of the lacrymal passages. Van Milligen (*Archives d'Ophtal.*, Nov., Dec., '89).

Epiphora may result from an obstruction of the lacrymo-nasal duct from swelling of the mucous membrane, having its primary origin in chronic or sub-acute post-nasal catarrh, while the same symptoms may arise from atrophic changes with contraction, a part of a similar process in the intranasal passages. Lacrymal abscess may be traced to chronic pharyngitis, with involvement of the mucous membrane of the lacrymal duct, producing true stricture, interference with drainage, and development of pathogenic organisms. De Schweinitz (*Cincinnati Lancet-Clinic*, May 14, '92).

Four methods by which nasal disorders may lead to eye-symptoms and eye-lesions: 1. By processes of growth, causing extension of tumors through the sinuses into the orbit or into the cranial cavity, and hypertrophies involving mechanically the nasal end of the duct. 2. By extension of infection through lymph-vessels and foramina or deficiencies in the bony walls, or by continuity of surface; spread of inflammatory processes into the lacrymal sac and into the orbit, thus affecting the intracranial portion of the optic nerve. 3. By circulatory disturbances, which occur in the form of venous congestion whenever mechanical conditions exist in the nose which impede the circulation. 4. By nervous disturbances. Gradle (*Jour. Amer. Med. Assoc.*, Sept. 10, '92).

Infection of the conjunctival sac by bacteria from the nose is impossible by

way of the lacrymal canal. Bach (*Archiv f. Ophthalmologie*, B. 40, H. 3, '94).

Pneumococcus, a normal occupant of respiratory tract, may cause ocular trouble by infection through lacrymal passages or endogenetically. Cuénod (*Ann. d'Ocul.*, May, '95).

Two cases of lacrymation caused by the presence in the mouth of decayed stumps of teeth, through induction of the chronic inflammation of the antrum and the nasal fossa, thence extending upward into the nasal duct. Puech (*Rec. d'Ophtal.*, Nov., '95).

In scrofulous persons exostosis of the nasal duct is a cause of stenosis. Galezowski (*Rec. d'Opht.*, No. 2, p. 166, '96).

Some cases of apparent closure of the nasal duct, with all the symptoms of dacryocystitis, are really due to the presence of groups of actinomycosis. Evetsky (*Arch. d'Ophtal.*, Apr., '96).

Obstinate unilateral lacrymation in a newborn child usually signifies obstruction of the tear-duct. Landolt (*Annales de Gyn. et d'Obst.*, Jan., '97).

Among the predisposing causes of diseases of the lacrymal passages are such defects of structure as flattening of the bony canal or other irregularities, and defects of refraction.

Syphilis, gout, phthisis, scrofula, or any of the infectious diseases may cause lacrymal disorder.

Among the local causes are conjunctivitis at the upper end of the lacrymal passage, and nasal disease at the other end, the morbid process in either instance spreading to the nearest canal. L. Conner (*Jour. Amer. Med. Assoc.*, July 2, '98).

Treatment.—While an absolute and a complete cure of lacrymal obstruction may be frequently attained, more often relief is only partial. If the obstruction in the duct be due to swelling of the mucous membrane merely, the prognosis is good; but if the stricture be of bony origin it may be regarded as incurable.

Treatment may be either palliative or curative. The former consists in repeatedly pressing the contents of the lacrymal sac into the nose by the finger,

and by the employment of antiseptic and astringent eye-washes, or by throwing a stream of boric-acid solution into the sac by means of an Anel syringe. Attention must be directed toward the nasal mucous membrane, and any local irritation existing about the nasal opening of the duct must be controlled with local applications.

In washing out the lacrymal passages, a hollow, conical cannula, which has its lower opening upon the side and a short distance above the terminal point, employed. Vignes (*Recueil d'Ophthal.*, Mar., '91).

The curative plan of treatment resolves itself into some form of surgical procedure. These measures have been conveniently classed by Theobald under four heads: 1. Those which aim to restore the natural passages. 2. Those which have for their object the formation of a new passage into the nose for the tears. 3. Those which aim at the obliteration of the natural passages,—the lacrymal sac and duct. 4. The removal of the lacrymal gland for the purpose of arresting the secretion of tears.

The first step toward the restoration of the natural passages consists in the operation of Bowman, which consists in slitting up the lower canaliculus throughout its entire length. This is accomplished by entering a fine canaliculus-knife into the inferior punctum, and by slowly pushing it along the floor of the canaliculus, until it abuts against the inner wall of the sac as it rests against the lacrymal bone. The handle of the knife should now be swept upward, while an upward and slightly backward inclination is given to the blade of the knife. A ready entrance into the sac being gained by the successful accomplishment of this act, attempts should be made to engage the stricture, and to dilate its caliber by means of probes. I generally first make

the attempt with a very small Bowman probe, and then gradually increase the size by passing slightly-higher numbers every second or third day. I am satisfied after a No. 6 probe, with a caliber of 1.50 millimetres, can be passed into the nose without difficulty. Larger probes are not employed, as they are apt to injure the mucous membrane and periosteum, and in some cases to lead to necrosis. Weber, Cooper, and Theobald, however, think sounds of the size of a Bowman No. 6 quite inadequate, and have devised probes of much larger caliber, employing instruments of a diameter of 4 millimetres in the treatment of the majority of their cases. As stated above, I am generally satisfied with a dilatation of 1.50 millimetres, and alternate the passage of probes by careful syringing of the duct with a weak solution of zinc and boric acid.

Routine slitting up of the canaliculi in every case demanding treatment of the lacrymal sac or nasal duct deprecated. Stenosis of the lower end of the nasal duct often can be relieved by the galvano-cautery. Gillet de Grandmont (*Recueil d'Ophthal.*, May, '90).

In stenosis of the nasal duct, method recommended by Benson, which consists in the use of removable styles, introduced by the patient and worn during the night. Hasbrouck (*Jour. of Ophthal.*, *Otol.*, and *Laryn.*, Apr., '90).

After first obtaining local anæsthesia by cocaine, electrolysis of the lacrymal duct may be effected by passing an ordinary Bowman probe into position, and then connecting the negative electrode of a battery with the handle of the probe by a *serre-fine*, and effecting continuity of circuit by forcing a small platinum tracheotomy cannula, to which the positive electrode of the battery has been fastened into the corresponding nostril so as to meet the probe. After this has been done, a larger-sized probe can be readily introduced. Gorecki (*Archives d'Ophthal.*, Sept., '90).

Summary of methods of treatment of affections of the lacrymal apparatus:

1. Epiphora: astringent and antiseptic collyria. 2. Catarrh, with and without stricture: in the first case, catheterism by Bowman's probes, followed by injections of sublimate, 1 to 3000; in the second, the injections will suffice. Finally, extirpation of one or both parts of the lacrymal gland. 3. Suppuration of the sac: if acute, incision of the anterior wall, bichloride wash, and iodoform dressing; if chronic, treatment for blennorrhœa; and, if this fails, incision of the sac and cauterization of the mucous membrane with actual cautery. 4. Lacrymal fistula and fungosities of sac: thorough destruction, by thermocautery, of the sac and its surrounding tissue. 5. Alterations of the bony walls: opening, scraping, curetting, and cauterization. Specific treatment, if required. Lagrange (*Gaz. Hebdom. des Sciences Méd. de Bordeaux*, Sept. 20, Nov. 1, '91).

Importance of examining the nasal passages after the passing of lacrymal probes, both in order to determine their position and to detect the presence of any abnormality which might tend to obstruct the lower end of the ducts. Cheatham (*Amer. Pract. and News*, Apr. 27, '93).

Lacrymal duct kept open by passing small-sized cannula containing probe through canal; cannula removed and split pea of lead fastened to one end of thread pulled up until its progress is arrested; second shot attached to upper end near punctum. Vilas (*Med. Rec.*, June, '95).

Use of large probes urged in the treatment of chronic cases of stricture of the lacrymal duct. G. M. Black (*Phila. Med. Jour.*, July 16, '98).

One hundred and thirty cases of lacrymal stricture treated with the large probes until pronounced cured; 40 of these were kept under observation for periods varying from 1 to 8 years and relapse had occurred in only 2 cases. H. O. Reik (*Phila. Med. Jour.*, July 16, '98).

Conservatism advisable in the treatment of epiphora and lacrymal obstruction; cutting operations are followed by only temporary relief, and subsequent

contractions make strictures worse than before. Lacrymal retention will often disappear with the cure of intra-ocular conditions. S. D. Risley (*Jour. Amer. Med. Assoc.*, Oct. 24, '98).

In tear-duct obstruction repeated probings have been almost entirely abandoned personally, the use of solid metal styles made of electrical-fuse wire being preferred. After dividing the lower canaliculus and the stenosed portion of the tear-duct by means of a specially constructed knife, a No. 6 Couper bulbous probe is inserted, and then the style. When the style is properly inserted, the bent upper portion should lie in the divided canaliculus without causing inconvenience, and without being seen except on eversion of the eyelid. The style need not be removed for two or three months, by which time the cure is generally complete. The only further treatment necessary is the use of an alum-and-boric lotion for bathing the eye, and the emptying of the sac by pressure over it with the finger. The treatment has been tested in about two hundred cases with gratifying results. McGillivray (*Glasgow Med. Jour.*, Dec., '99).

In lacrymal obstruction and suppurative conditions of the lacrymo-nasal passages, the following procedure is superior to probing: A long silver probe with an eyelet is threaded with coarse silk and passed into the canal until it emerges from the nose, whereupon the two ends of the thread are tied. It is preferable to tie a large knot so that by pulling the string through the canal, which is done two or three times a day, a larger opening is produced. The string is removed in one week. The operation can generally be performed under cocaine anæsthesia. Pond (*Med. Record*, Feb. 2, 1901).

In infants operative procedure should be postponed until palliative measures have been thoroughly tried, although in obstinate cases this may be successfully accomplished under a general anæsthetic.

To prevent closure of the duct after it has been made patulous, a number of operators insert a leaden style, leaving

this in position for several weeks or months. This is of especial value when the patients live at a distance, and cannot submit to the frequent and continued probing which is necessary to attain the best results.

The use of the style made of pure silver, not larger than the No. 6 Bowman probe, and having the upper end bent so as to lie on the side of the nose close to the caruncle, recommended. This is worn from four to twelve weeks, according to the pathological character of the stricture. After this mild irrigation of the passages with the aid of a dental syringe completes the recovery. A large probe may be introduced once in two weeks, until it is evident that all tendency to relapse has disappeared. H. D. Noyes (N. Y. Eye and Ear Infirmary Reports, Jan., '99).

There are many which require more radical measures than those usually resorted to. Rapid and sure relief is obtainable by extirpation of the lacrymal sac and gland. This takes away the source of irritation, and not only does away with the disease of the sac and its dangers, but diminishes the flow of tears materially. Removal of the larger lacrymal gland causes surprisingly little diminution in the apparent moisture of the conjunctival sac. It is only when the eye is exposed to stimulus that the difference is usually apparent, and then the diminution is relative. History of five cases is given. W. B. Lancaster (Boston Med. and Surg. Jour., Jan. 10, 1901).

Extirpation of the sac most satisfactory in cases of long duration with more or less profuse muco-purulent secretion, in all cases with fistula, in those with changes in the periosteum and with caries of the bone, and in those resulting from the action of caustics or from trauma, in cases with prolonged conjunctivitis, ulcerations of the lids, and in trachoma. Albrand (Deutsche med. Woch., Apr. 4, 1901).

Other surgeons prefer rapid dilatation, and insert probes of the largest size into

the duct at the first sitting, this being usually performed under ether.

Electrolysis in stricture of the lacrymal canal found rapidly effective in a series of cases in which probing extending over a long period had failed to afford relief. Its advantages are: absence of pain, no bleeding, and antiseptic action. Three milliampères should not be exceeded; and the sittings two minutes. The positive pole is a flat sponge applied to the nape of the neck. The canal, after withdrawal of the probe, is washed out with a 4-per-cent. solution of protargol. L. L. Mial (N. Y. Med. Jour., Oct. 20, 1900).

In intractable cases—as, for example, when the stricture is bony—two procedures have been practiced: the removal of the lacrymal gland and the obliteration of the lacrymal sac. The former of these has been modified by de Wecker, who excises the little lobules and the emissary ducts from both the subsidiary and main lacrymal glands.

Number of cases in which lacrymation persisted after dacryocystitis, although the nasal duct and tear-passages generally were restored to their normal condition. In some instances of this kind the writer has observed an hypertrophied caruncle the removal of which has cured the lacrymation. So long as the canaliculi are intact a large caruncle has little bearing on lacrymation. The puncta dip into the lacus at a point external to the caruncle. If, however, the canaliculus has been incised to admit the passage of probes, the opening is carried inward, and the pressure of the caruncle may be sufficient to block it by pressing the walls into contact with one another. In these patients the removal of the projecting part of the caruncle sufficed to occasion cessation of lacrymation. The excision can be readily performed under cocaine. Augiéras (La Clinique Opht., June 25, 1902).

A simple operation to replace extirpation of the lacrymal sac. In some conditions, such as *ulcus serpens*, it is most necessary to insure that the cor-

nea is not infected by microbes from the lacrymal sac. It is not sufficient to catheterize the canal and wash out the contents, and incision or excision of the sac seems unnecessarily severe. Occlusion of the canaliculi may be obtained by the galvano-cautery. The immediate result expected was a retention of pus in the sac, involving the need of a subsequent excision; but instead, the sac did not become more distended, and the inflammation subsided. The cessation of inpouring tears sufficed to bring about a cure of the dacryocystitis. The method is simple. The canaliculus is dilated, and a point of the galvano-cautery introduced for about 4 millimetres; then the current is turned on, and the glowing point is allowed to remain for about two seconds. Schultz (La Clinique Ophthalmol., Mar. 19, 1904).

Obliteration of the sac is but little practiced at present, but is best accomplished by means of the galvanocautery. If a fistula remain after abscess of the lacrymal sac, it may be healed by applying the galvanocautery to its freshened edges.

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LACTATION. See **NURSING.**

LACTUCARIUM.—Lactucarium is the concrete milk-juice of *Lactuca virosa*, of the family *Compositæ*, a wild variety of lettuce growing in Europe. It occurs in irregular, brown lumps, which are wax-like internally when cut, and possess a narcotic odor and a bitter taste. It is soluble in alcohol, ether, and partly soluble in water. Lactucarium contains 58 per cent. of lactucerin (white, crystalline, and soluble in alcohol), lactucin (bitter principle in fine, white scales, and soluble in alcohol and 80 parts of water), and lactucic acid.

Preparations and Doses.—Lactucarium, 5 to 60 grains.

Syrupus lactucarii, $\frac{1}{2}$ to 2 fluidrachms.

Tinctura lactucarii, 10 to 60 minims.

Poisoning by Lactucarium.—Lactucarium is a feeble narcotic poison. When taken in overdose the symptoms are similar to those of opium poisoning. In the treatment of poisoning by lactucarium the same measures that are used in opium poisoning are indicated: the stomach should be evacuated if possible; the patient should be roused and kept moving; apomorphine, ammonia, coffee, douche, atropine, amyl-nitrite, artificial respiration, and electricity may then be used.

Therapeutics.—Lactucarium is chiefly used in slight irritation of the larynx to allay nervous irritability and in cases where there is an idiosyncrasy against opium. The syrup is used in cough-mixtures for children and delicate subjects. Aubergier's syrup and paste are active, uniform, and palatable. Lactucin may be used as an hypnotic and sedative in the dose of 1 to 2 grains.

LARYNGITIS AND KINDRED DISORDERS.

Definition and Varieties.—The term "laryngitis" means inflammation of the larynx; but to properly distinguish the various inflammatory disorders to which this organ is liable, several types of laryngitis are recognized: *Acute laryngitis*, in which the mucous membrane alone is supposed to be inflamed; *œdema of the larynx*, in which the deeper tissues become infiltrated; *symptomatic laryngitis*, in which œdema and phlegmon may complicate acute laryngitis as a result of microbic infection; *chronic laryngitis*, in which any of the lesions of inflammatory origin observed in the foregoing varieties have assumed chronicity. These types include several disorders to which indi-

vidual names have been given, but they appear to represent but stages or degrees of the classical forms.

Acute Laryngitis.

Symptoms.—Acute laryngitis in the majority of cases is the result of the temporary extension of a chronic catarrhal process existing in neighboring tissues, especially the nose, the pharynx, or the tonsils. In professional singers, for instance, constant traveling, with its attending variations in climate and temperature, frequent exposure to dust and smoke, etc., generally keep up catarrhal disorder of the naso-pharyngeal tract. The hyperæmia thus induced readily extends by continuity of tissue to the vocal organs under the influence of any undue exposure, dampness, cold, or any factor capable of irritating the laryngeal surfaces. The larynx in such cases may be said to be predisposed to a mild form of catarrh which appears more or less frequently. In such cases the subjective symptoms mainly consist in a constant desire to “hem” and a feeling of constriction at the throat. The voice is altered in quality and pitch; it becomes gruff, and hoarseness, more or less marked, follows. Under the influence of proper treatment and rest the local hyperæmia quickly subsides, but the continued use of the voice prolongs the inflammatory process and tends to permanently compromise the integrity of the organ as an instrument.

A laryngoscopic examination sometimes yields but little evidence of inflammation, the interarytenoid space alone showing slight hyperæmia. In the vast majority of cases, however, the entire larynx shows congestion, the vocal bands being distinctly red. Much faith cannot be placed upon these signs, in the case of male singers, however, the vocal bands being frequently pink and even red in

the normal state; but in women, local redness usually means active congestion, unless the patient be addicted to excessive use of alcoholic drinks.

In persons in whom the voice is not subjected to more than ordinary uses, an attack of acute rhinitis frequently precedes the laryngeal disorder. When, however, the laryngitis is primary, hoarseness usually occurs as the first symptom, though slight chilliness occasionally alluded to is a premonitory sign. The voice is lowered in pitch, a pricking sensation is experienced in the larynx, which causes hacking and aggravation of the local congestion. There is usually some cough, slight dyspnoea, and occasionally some pain during deglutition. There may be a slight rise of temperature. The expectoration, at first jelly-like and viscid, becomes more copious. As this proceeds, the hoarseness becomes more marked and persists for some days, sometimes weeks.

When examined laryngoscopically the larynx is found markedly congested. The entire laryngeal membrane may be involved, or the congestion may be limited to the vocal bands and the intra-arytenoid tissues, the redness gradually fading off toward the upper portion of the laryngeal walls, except posteriorly.

Some cases of acute laryngitis are attended by hæmorrhagic symptoms, the expectoration of blood usually following violent coughing. Besides the usual laryngeal manifestations, there is generally to be found a circumscribed patch, the seat of rupture of a superficial vessel. In some cases there is no expectoration of blood, but the vocal bands show a red spot, or localized hæmorrhagic infiltration. It sometimes shows itself independently of a catarrhal condition as a result of undue strain in using the voice. It is probable, however, that a latent

catarrhal process is always present in such cases, and that the vascular walls are inordinately weak.

Case of acute hæmorrhagic laryngitis and record of several cases hitherto published. Cardonne (*Il Progresso Medico*, Apr., '88).

Hæmorrhagic laryngitis is an acute catarrh of the larynx, accompanied by hæmorrhage of the inflamed mucous membrane, owing to certain peculiar conditions, local or general. La Placa (*Archivii Ital. di Larin.*, Oct., '88).

Case of hæmorrhagic laryngitis in a healthy woman, 30 years of age, two months gone in pregnancy. Attention called to the fact that three out of six cases reported by Strübing occurred in females during pregnancy or shortly after. Treitel (*Deut. med.-Zeit.*, Feb. 9, '91).

Laryngeal hæmorrhage may be of rheumatic origin. Immobility of the vocal cord, with consequent huskiness, is one of the commonest manifestations of the larynx. G. Hunter Mackenzie (*Edinburgh Med. Jour.*, Dec., '94).

Laryngitis hæmorrhagica attributed to the great swelling and hyperplasia of the mucous membrane, the increase in size and number of the vessels, the lessened resistance of their walls, and the frequent and periodically increased blood-pressure from coughing, hawking, etc.

Every idiopathic laryngeal catarrh is entitled to be termed "laryngitis hæmorrhagica," which, without external cause, and with intact mucous membrane, is accompanied by hæmorrhages on or into the mucous membrane. S. Salzburg (*Jour. of Laryn.*, etc., Oct., '97).

(See colored plate.)

THE RHEUMATIC DIATHESIS predisposes to a disorder of the larynx simulating acute laryngitis, but differing from it in that local phenomena are usually less active objectively. The voice is used with difficulty and the pain is sometimes much more severe than that experienced in other inflammatory disorders. There is dyspnœa in the majority of cases.

Rheumatism of the larynx sometimes

occurs in conjunction with general rheumatism. It is a serious disorder, particularly in singers; one or both of the cricoarytenoid joints may be involved in the inflammatory process, and permanent hoarseness often results.

In predisposed patients the rheumatic laryngitis may be for weeks or months the only symptom of rheumatism. W. Freudenthal (*Jour. of Laryn.*, Feb., '95).

Case of a man, with acute generalized articular rheumatism, in whom there occurred, as the articular pains subsided, pharyngeal and laryngeal odynphagia, and pharyngeal dyspnœa. Luc (*Annales des Mal. de l'Oreille*, etc., Mar., '92).

Five cases of acute rheumatic cricoarytenoid synovitis following colds. Grünwald (*Berliner klin. Woch.*, No. 26, '92).

If the cricoarytenoid articulation is affected in rheumatic laryngitis, it is doubtful if the corresponding vocal cord will ever regain its normal range of movement, and the voice may be more or less permanently affected. G. Hunter Mackenzie (*Edinburgh Med. Jour.*, Dec., '94).

Etiology.—Generally speaking, laryngitis may be said to be due either to conditions causing local congestion by mere overuse or mechanical irritation, or by continuity of tissue.

The forms thought to be independent of specific germs are those due to exposure to cold and damp, the inhalation of smoke, especially tobacco-smoke in a badly-ventilated room, dust, irritating fumes, spices, irritating particles of all sorts, etc. Excessive use of the voice and the ingestion of alcoholic drinks, of hot or overspiced food are also frequent causative factors.

Nine cases of catarrhal laryngitis the result of bicycling, tricycling, etc. The disease is attributed to the improper position taken by these subjects in their exercise, inclining the body forward and thus impeding respiration and rendering it necessary to respire by the mouth as well as the nose, while the rapidity of the pace drives the air into the larynx and

lungs under increased pressure. Ragonneau (*Revue de Laryn.*, etc., Nov. 15, '91).

Case of acute laryngitis caused by potassium iodide. Contrary to the other recorded cases of a similar character, it was not a simple œdema, but an intense hyperæmia and infiltration of the mucous membrane and of the submucous tissue. Frankenberger (*Therap. Monats.*, vol. xii, No. 4, '97).

As already stated, catarrhal diseases of nose and naso-pharynx greatly predispose to acute laryngitis, and the majority of cases witnessed show such a condition as a primary factor. Singers, army-officers, ministers, etc., are especially prone to this disorder on this account, particularly when the voice is improperly used; but the presence of a primary catarrhal disorder of the naso-pharyngeal tract may usually be discerned.

Catarrhal affections of the larynx are always secondary to nasal and pharyngeal catarrh. The exceptions to this rule are where the larynx has been locally irritated by the inhalation of irritant gases or by sprays of too strong a solution. One other exception is seen in public speakers, actors, and singers. Rice (*Postgrad.*, May, '98).

Patients whose urine contains sugar, but whose general health has not yet suffered, often complain of a peculiar dryness of the throat and insufficiency of the voice after use. The posterior pharyngeal wall is then found to be dry, smooth, glistening, and copper-colored and the vocal cords have a peculiar shiny, glazed appearance. These signs are diagnostic of early diabetes. O. Leichtenstern (*Münchener med. Woch.*, Apr. 17, 1900).

Epidemic of tracheo-laryngitis among troops on a British transport, one hundred and twenty cases out of a thousand men being attacked. Shivering or nausea suddenly occurred, soon followed by a temperature of 102° or 103° F. There was no sign of involvement of the tonsils or pharynx, but there was severe cough, pain in the larynx, huskiness, and

finally loss of the voice, and subsequent involvement of the trachea. C. Gibbs (*Brit. Med. Jour.*, Apr. 28, 1900).

Pathology.—In the idiopathic form of acute laryngitis the superficial vascular supply is mainly at fault and there are very few cases in which a certain amount of cellular infiltration does not occur, and the line of separation between the superficial and deeper changes is not easily discerned. The primary factor in such cases is probably vasomotor, and if the paresis of the vascular nerves is marked the serous infiltration by diapedesis into the tissues may be such as to give rise to slight tumefaction. The epithelium may be softened and localized, desquamation occurring; diminutive erosions are sometimes found.

Treatment.—The patient should remain in a warm room, refrain from talking and smoking, and not allow others to smoke around him. Hot food increases the local congestion and especially the hot alcoholic drinks so frequently indulged in. Cracked ice and ice-cream are usually grateful to the patient and beneficent to his throat.

An acute attack of laryngitis due to "cold" may often be arrested by the early internal use of bromide of potassium and opium. Twenty grains of the former, with 2 drachms of paregoric, repeated every three hours usually reduces the laryngeal hyperæsthesia which lies at the bottom of the local symptoms to a minimum, while the likelihood of any complication is greatly decreased. The somnolence also induced tends to reduce the localized congestion. After this effect is obtained, the dose may be reduced by half and taken every two hours, two or three times. A bottle of citrate of magnesium taken the next morning often brings on the stage of resolution. This may be encouraged by means of the official compound guaiac lozenges.

In some cases the inhalation of steam impregnated with the compound tincture of guaiac is quite effective, but not nearly as much so as the method given above, which it is calculated to replace, when patient cannot take the bromides. One teaspoonful of the compound tincture is placed in a pitcher of water as hot as obtainable; the vessel is covered with a towel folded into the shape of a cone; the mouth and nose are inserted into the open top of the cone, and the steam is inhaled deeply as long as it is emitted.

The inhalation of steam charged with the compound tincture of benzoin is preferred by some clinicians. It may be employed in the same manner as the tincture of guaiac.

Inhalations by means of an atomizer of a cold 2-per-cent. solution of ichthyol repeated twice daily, and not too deeply inspired for fear of producing nausea and vomiting, have given excellent results in acute laryngitis. Ciegiewicz (Vratch, xix, No. 8, '98).

In acute laryngitis, without œdema, inhalations of steam containing camphor-menthol will often in the early stages aid considerably in aborting an attack, while after the disease has existed for a day or so the addition of benzoin will aid in allaying the cough and irritation. When œdema is present, hot inhalations are of little value and frequently increase the extent of the swelling, while an iced spray of $\frac{1}{2}$ - to 1-per-cent. camphor-menthol, alternating every half hour, or even fifteen minutes in cases where the dyspnœa is severe, with a spray of the suprarenal gland, will produce a rapid change in the appearance of the laryngeal swelling and frequently relieve the dangerous symptoms. L. S. Somers (Merck's Archives, Dec., 1901).

In many cases the local disorder is greatly influenced by general disorders. In female professionals, especially, constipation is almost the rule, owing probably to their irregular mode of living,

their varying diet, and the continued traveling in railroad-cars. Purgatives, even mild aperients, are, for obvious reasons, out of the question when evening after evening the sufferer is to appear upon the stage. Enemata, while being immediately effective, present the advantage of not diminishing the patient's strength. An enema composed of one pint of lukewarm water and a tablespoonful of glycerin will sometimes be found to act surprisingly, not only on the intestines, but on the voice, especially if, as is often the case with traveling artists, the bowels have not been moved for several days. If fever is present, drop doses hourly of tincture of aconite will usually reduce it markedly.

In cases in which the bromides and opium cannot be given, a solution of resorcin or alumnol, 7 grains to the ounce, should be used with an atomizer about every two hours the first day, then three times daily. To enable the solution to thoroughly bathe the bands, the voice should be sounded during inhalation, while the fluid is being sprayed in, the bands being thus brought in and forming a floor, as it were, at the lowest portion of the larynx. When the hoarseness is great, an application with cotton pledget of carbolyzed iodotannin or a solution of perchloride of iron, 20 grains to the ounce, causes a sudden contraction of the capillaries, which is effectively maintained by the resorcin solution.

To hasten the process of resolution, a pill composed of 1 grain of quinia and $\frac{1}{4}$ grain of nux vomica, administered every two hours the first day, then four times a day. Mariani's coca-wine, a wine-glassful being taken every three hours during the day, is especially effective in this connection, but the last dose must be taken at least three hours before using the voice professionally.

In the treatment of rheumatic disorders of the larynx local measures are practically useless. The benzoate of sodium is sometimes quite effectual, 5 grains being given every three hours. Salicylate of sodium is the standard remedy when it can be tolerated. (See RHEUMATISM.)

Œdema of the Larynx.

Œdematous infiltration of the larynx may occur as the result of a simple catarrhal process, of traumatic laryngitis, or as a complication of infectious disorders, proximate or remote.

Symptoms.—The first manifestation may be a chill, soon followed by hoarseness and laryngeal pain. The most prominent symptom experienced almost from the start is a sensation of constriction at the throat and gradually increasing dyspnœa, most marked during inspiration. There is also local heat, dryness, and a muffled cough, which the patient aggravates by efforts to rid the surfaces of a supposed secretion. There is increasing huskiness, both inspiration and expiration being finally impeded. In favorable cases there is a gradual decline of all symptoms; but this course is not always observed, and, unless prompt relief is afforded, the patient dies of asphyxia. The temperature is not, as a rule, much above the normal.

Nine cases of acute laryngitis sufficiently grave to cause dyspnœic recession of the chest during inspiration. The pulse invariably became small during the same period. As the disease progressed, the symptom became more and more marked until, just before tracheotomy was done in the cases requiring it, the pulse was found to be almost imperceptible during inspiration. The moment the trachea was opened and air allowed to freely enter the chest the pulse resumed its regularity in volume and rhythm. Brockbank (*British Med. Jour.*, June 24, '93).

Case of acute œdema characterized by the following features: (1) the absence of any known causative agency and constitutional symptoms; (2) the extent of œdema which may occur without marked dyspnœa; (3) the peculiar character of the voice; (4) the marked benefit of prompt treatment without scarification; (5) the possibility of the case belonging to a group of obscure clinical manifestations known as angio-neurotic œdema or allied vasomotor phenomena. J. H. Pryor (*Med. Record*, July 28, '94).

The laryngoscopical examination reveals local changes varying with the cause of the œdema. When the latter is secondary to acute laryngitis, the upper portion of the larynx over which the tissues are comparatively loose are swelled and red or reddish yellow. The epiglottis sometimes appears as a thick cushion, covering two sausage-like bodies under it, the aryepiglottic folds. As the tissues swell, these tend to roll inward, forming a series of cushions whose edges gradually approach one another, steadily reducing the lumen of the laryngeal cavity. When the œdema is the result of traumatism or contact with corrosive acids, etc., there is great redness and supplementary local lesions. Marked inflammatory swelling also attends the erysipelatous form.

When œdema is due to a general disorder, the mucous membrane is, as a rule, paler than when it occurs as a complication of a local inflammatory process.

In œdema of the entrance of the larynx the passage to the glottis is obstructed most especially by swelling of the inner layer of the aryepiglottic folds, which lie like two morbid growths upon the ventricular bands, and thus become a great impediment to respiration. Hajek (*Archives Gén. d'Hydrog.*, etc., B. 42, H. 1, '91).

In œdema occurring as a result of inhalation of steam, fire, caustic vapors, or to the deglutition of too hot liquids, or

corrosive substances taken accidentally or with suicidal intent, such as carbolic acid, sulphuric acid, etc., the onset of the symptoms is comparatively sudden. Dyspnœa and spasm sometimes occur from the start, and all the symptoms of acute laryngitis enumerated are increased in intensity. The gravest local manifestation of laryngeal inflammation, œdema, is soon reached. In the majority of cases met with, however, after a series of acute manifestations, momentary dyspnœa and laryngeal spasm, etc., which the physician does not, as a rule, witness, the larynx assumes a comparatively normal condition, as far as the patient goes, though, however, the laryngeal structures become infiltrated and after a few hours—sometimes an entire day—the most distressing symptoms appear, and the patient dies asphyxiated, unless relieved. (*See colored plate.*)

The upper portion of the larynx may show evidence of tissue-destruction when such agents as carbolic acid, ammonia, etc., have been used; but in the majority of cases laryngoscopic examination only reveals intense redness of all the laryngeal tissues, with slight swelling. The active congestion may be localized, this depending upon the causative agency. In laryngitis due to burning fluids the epiglottis may alone be involved, but in the vast majority of cases neighboring pharyngeal tissues, the interarytenoid space, the ventricular bands, and the vocal bands take part in the inflammation.

Etiology and Pathology.—The œdema occurring as a result of simple catarrhal laryngitis is usually brought on by undue exposure to damp cold air while the body is overheated by violent exercise, such as dancing, fencing, etc. *Décolleté* gowns and the luxury of sitting at an open window after dancing, and drinking of ice-

water, have thus caused many victims—sudden deaths credited to heart disease.

Two cases of œdematous laryngitis requiring tracheotomy, both caused by drinking ice-water when the patients were in an overheated condition. Vladimir A. Paduecheff (Trans. Ural Med. Society, p. 26, '92).

Case of œdematous laryngitis following cold, in a vigorous soldier. Tracheotomy became necessary. L. Dorange (Archives de Méd. et de Pharma. Milit., July, '92).

Œdema of the larynx has also been observed in cases treated with iodide of potassium, the connection between the disease and drug being shown by the reduction of the œdema when the drug is withdrawn. (See IODINE, in this volume.)

Two cases of œdema due to iodide of potassium. The first was a carcinoma of the larynx, in which an antisyphilitic treatment was instituted to eliminate the possibility of syphilis. After about 15 grains of iodide of potassium had been taken, laryngeal œdema developed to such an extent that a tracheotomy was required. In the second case, which was thought to be syphilitic, the epiglottis, arytenoids, and ventricular bands were œdematous, and the patient suffered from dyspnœa. On administering iodide of potassium for a day or two, the œdema and dyspnœa increased. After leaving off the iodide of potassium the œdema quickly improved in both cases. The remedy was administered later in the second case, without causing œdema. Schmiegelow (Archiv f. Laryn., vol. i, No. 1, '93).

It is probable that a latent disorder of the larynx is present in such cases. This may have existed before the use of the iodide or occur as a result of the disease—syphilis, for instance—for which the drug has been administered. Lesions of the kidney may mechanically induce laryngeal œdema by interfering with the free elimination of fluids.

Acute œdema of the larynx in two cases due to iodide of potassium: 1. Case

of pulmonary laryngeal phthisis. Five days after potassium was begun a considerable œdema of the left aryteno-epiglottic fold was noticed, which disappeared when the iodide was discontinued. 2. Case in which patient was given potassic iodide for syphilitic manifestations. After two weeks there was coryza and dyspnoea and œdematous swelling on the right side of the larynx. The iodide was omitted, and the swelling disappeared. The œdema was unilateral in both cases, a feature not often met with in cases hitherto recorded. Stankowski (Münch. med. Woch., Mar. 23, '97).

Existence established of an early syphilitic œdema of the larynx, independent of all ulceration or erosion, and itself the solitary notification that the specific virus has attacked that organ. Lacroix (Archives de Laryng., Nov.-Dec., '97).

As the cause of œdema of the larynx is more thoroughly studied the cases that cannot be ascribed to either some pre-existing local affection in either the pharynx or the larynx or to some constitutional disease or external irritation will be exceedingly rare. C. C. Rice (N. Y. Med. Jour., Dec. 3, '98).

There are several types of idiopathic œdema of the larynx. First there are those cases in which there is no true inflammatory condition of the mucous membrane, but simply a transudation of serum into the submucosa. This condition is found in cases of far-advanced nephritis with cardiac and vascular changes. Another type is that found accompanying acute catarrhal laryngitis. The condition may also be of an infectious or septic origin. The latter class of cases is frequent during epidemics of influenza. J. S. Gibbs (Jour. Amer. Med. Assoc., July 20, 1901).

Many of the cases of œdema of the larynx are thought to be of infectious origin, exposure of the parts to weakening influences of cold, etc., facilitating the entrance of micro-organisms of neighboring inflammatory processes, particularly of the naso-pharynx. The base of the tongue, the mouth, and the tonsils are known to be sources of infection.

Acute primary œdema of the larynx is an infectious disorder, streptococci and pneumococci having been found in several cases of that affection. Cold and traumatism considered as but occasional causes favoring the penetration of germs into the organism. F. Barjon (Gaz. des Hôp., May 19, '94).

In acute œdema, especially the septic form, which occasionally develops in the course of tubercular, malignant, or syphilitic laryngitis, the patient may be at his work, and suddenly become the victim of this form of œdema. Unless tracheotomy be immediately performed, the patient speedily dies. This œdema is due to the breaking down of the diseased laryngeal tissue. In this way a path is opened to the passage of extraneous bacteria. These microorganisms, or their toxins, then excite the vasomotor nerve-endings, causing a sudden dilatation of blood-vessels, with a consequent discharge of serous or serosanguineous fluid into the loose tissue beneath the mucous membrane. Prompt treatment is necessary if life is to be saved. H. T. Smarthwaite (Northumberland and Durham Med. Jour., Apr., 1903).

Inflammatory disorders of the glands of the neck, parotitis, tonsillitis, etc., may thus suddenly be complicated with œdema of the larynx with its attending dangers.

Case of œdema of the larynx resulting from pyæmia, which seemed to have followed the introduction of a sound to relieve a urethral stricture following gonorrhœa. Bryan (Med. News, Feb. 6, '92).

Burning or scalding of the larynx, traumatism,—such as those induced by the passage of foreign bodies, sharp bones, tacks,—etc., may, as stated, also act as etiological factors. Even alcohol has been known to produce localized œdema.

Œdema of the larynx comprises all cases in which the œdema is a consequence of another local or general process; no inflammatory reaction is present; the etiological factors include Bright's disease, cardiac affections, venous stasis,

1.



2.



5



3



4



Inflammatory disorders of the larynx (Robert Krieg)

1. Acute Laryngitis 2. Acute inflammation of epiglottis. 3. Acute inflammation of Ventricular Bands
4. Hæmorrhagic Laryngitis. 5. Early stages of oedema.

Atlas der Kehlkopfkrankheiten. F. Enke, Publisher. Stuttgart.

anæmia, and general hydræmia and angioneurotic processes. Kuttner (Virchow's Archiv, Jan. 4, '95).

Records of autopsies made under charge of Virchow, between 1873 and 1878, examined by Peltessohn gave the following results:—

In 3887 examinations, œdema of the larynx was noted 210 times,—149 in men, 40 in women, and 21 in children. Forty-four cases had occurred in regional disease and 166 in systemic disease. Of 5161 patients treated in the clinic for diseases of the throat and nose, between April 1, '87, and June 1, '89, there were only 8 with acute œdema of the larynx, —7 in men between 21 and 48 years of age and 1 in a woman 58 years of age.

Pathology of the inflammatory conditions of the larynx associated with œdema and redness. In a fatal case of a man, 48 years of age, histological examination of the mucous membrane of the larynx showed the presence of a considerable round-cell infiltration of the submucous layer. The case, therefore, represents secondary erysipelas of the larynx, which would probably, had the patient lived longer, gone on to perichondritis and abscess-formation. The infection took place through the blood from an inflammatory process of the leg. G. Sittmann (Deut. Archiv f. klin. Med., Dec. 13, '99).

Prognosis.—Œdema of the larynx is at times so rapidly fatal that no warning of the oncoming issue is afforded. A patient suffering from slight hoarseness on retiring may thus be found dead next morning. Though such cases are comparatively rare, they nevertheless show the importance of promptly attending to acute laryngeal maladies. When the iodides are being administered in connection with throat disorders, the larynx should be frequently examined laryngoscopically.

Cases in which the infiltration is localized are obviously less likely to prove

mortal than those involving all the tissues. The latter form is that most frequently met with when general disorders—such as scarlet fever, typhoid fever, variola, etc.—act as the primary factor.

Sestier found that the affection proved fatal in 158 out of 213 cases in spite of tracheotomy performed thirty times. In the 55 cases which recovered tracheotomy was performed twenty times. Bayle reports 17 cases with 16 deaths. F. E. Hopkins (Med. Record, Oct. 19, '95).

Treatment of Œdema of the Larynx.—

When œdema is present vigorous measures should be adopted when dyspnoea becomes evident. Until then, cracked ice should be kept in the mouth and cold-water compresses applied around the throat. The patient should be well covered and given a hot mustard foot-bath, then immediately placed in bed, but in the sitting posture, and wrapped in blankets—the object being to cause normal diaphoresis. If this cannot be obtained normally, pilocarpine should be given hypodermically, or internally if the local manifestations are not marked.

The bromides are useful in reducing the local infiltration, and a dose of 20 grains in an adult, repeated as often as needed, sometimes proves very efficacious.

Pilocarpine injected hypodermically proves very efficacious in reducing laryngeal œdema. Six drops of a 5-per-cent. solution of the alkaloid, repeated three times at intervals of fifteen minutes, caused complete relief in the cases reported. Suarez de Mendoza (Revue de Laryng., Aug. 15, '91).

If a case be seen at the beginning of an attack, the treatment consists of inhalation of warm medicated vapor, the use of diaphoretics, the maintenance of the patient's room at an equable temperature (72° F.), with the air moistened by the vapor of boiling water, and at a later stage the application of leeches over the region of the larynx, to be followed by the continuous use of the cold coil. The

sucking of pellets of ice is also to be recommended. Upon the appearance of œdema, however, scarification with the laryngeal lancet should be performed. F. E. Hopkins (*Med. Record*, Oct. 19, '95).

Application of leeches to the front of the neck is very effective in acute and primary laryngeal œdema. Levi and Laurens (*Archiv. Gén. de Méd.*, Dec., '95).

In a case of acute idiopathic œdema of the epiglottis in a man of 41, a spray of ichthyol, $\frac{1}{3}$ per cent., in ice-water every fifteen minutes, with ice externally, gave rapid relief. W. P. Meyjes (*Jour. of Laryn.*, etc., Mar., '97).

Acute submucous laryngitis in children, characterized anatomically by submucous infiltration, bearing a misleading resemblance to acute œdema, is manifested clinically as a suffocative catarrh.

A point of particular diagnostic importance is the association of an unimpaired voice with a hoarse cough. Intubation is indicated when retraction is marked. Castaneda (*Jour. of Laryn.*, *Rhin.*, and *Otol.*, Apr., '97).

Intubation in stenosis of the larynx should be employed only by physicians who are expert in its performance. The patient should be carefully watched until the results are satisfactory; the tube should be selected according to the nature of the case. Trumpp (*Münch. med. Woch.*, Mar. 31, 1903).

Tincture of belladonna, 5 drops every hour until its physiological effects become marked, also tends to counteract the infiltration by contracting the laryngeal blood-vessels.

Astringent solutions should only be used in circumscribed œdema, a weak solution of tannin, alumnol, or resorcin being valuable in such cases. When the cases can be closely watched, a 10-per-cent. solution of cocaine applied directly to the larynx causes momentary—though slight—retraction of the tissues, and may thus be advantageously used especially when surgical measures are to be resorted to: scarification, intubation, or tracheotomy. In some cases, however, it seems to increase the dyspnœa.

When the dyspnœa becomes urgent, scarification of the laryngeal tumefaction is indicated. With the assistance of the laryngeal mirror—held in the left hand—the procedure is quite easy after anæsthetizing the laryngeal tissues with a 10-per-cent. solution of cocaine. The pocket-case curved bistoury is wrapped in a piece of bandage held in place with thread up to within an eighth of an inch of the tip, to prevent cutting the tongue with edge of the blade. The tongue being drawn out and held by the patient, the epiglottis will generally be seen standing erect, and looking, when much infiltration exists, not unlike a pale cherry. This should not be punctured first, as the patient may refuse a second incision and the first should be the most profitable one to him. The portion playing the most important part in the production of the dyspnœa is the aryepiglottic fold, and this can usually be depleted by means of a short incision into its external border, thus causing the blood and serum to flow into the pyriform sinus, instead of into the larynx proper. When the patient is docile, both sides can be scarified and the epiglottis also, care being taken to prick the edges with the point rather than the internal aspect of the laryngeal walls.

When a laryngoscopic mirror is not at hand, the index finger of the left hand should be passed behind the epiglottis and used as guide for the curved bistoury.

At times scarification even when thoroughly carried out, does not relieve the dyspnœa. In that case the lower portion of the larynx and the tissues beneath the vocal bands will probably be found involved in the inflammatory process, when examined laryngoscopically—if seen at all. Under these circumstances either intubation or tracheotomy must be resorted to. (See INTUBATION and TRACHEOTOMY.)

In acute circumscribed œdema of the larynx scarifications should be made. Landgraf (Jour. of Laryn., Apr., '94).

In the early stages of primary œdema cold applications externally, broken ice, and tannin; later on hot fomentations should be applied to the neck. The respiratory difficulty often yields to ether or sodium bromide with syrup of chloral. Insufflation of tannin solution is more valuable in serous than inflammatory œdema; in the latter pilocarpine injections are preferable. Scarification condemned. Tracheotomy preferred to intubation, since the passage of the cannula in the latter case is often stopped by the œdema. Attention must be paid to the general condition. L. Bar (Allg. Wien. med.-Zeit., Aug. 11, 18, 25, '96).

When laryngitis is due to traumatism and the manifestations are not sufficiently marked to require operative measures, considerable pain is sometimes present; again, the lesion is so exposed that infection may occur, a benign process thus being transformed into a severe one. The most satisfactory results are to be obtained by strict cleanliness through the use of a 5-grain solution of borax applied with the atomizer, the laryngoscopical mirror being employed to properly locate the spray. Two grains of pure iodoform are then applied with the insufflator. This reduces the pain and curtails the infectious process in any form of laryngitis in which these elements prevail.

Symptomatic Laryngitis.

This term is sometimes applied to the laryngeal manifestations occurring in the course of general diseases, and involving, as a rule, the deeper structures. The symptoms vary with the intensity of the local manifestations, and may range from those of a simple laryngeal catarrh to the most severe œdema calling for immediate tracheotomy. Complications of so dangerous a nature are fortunately rarely witnessed.

Measles is usually attended by inflammatory involvement of the larynx. There is hoarseness and sometimes loss of voice, the symptoms, in fact, being quite those of acute laryngitis, including occasionally slight tumefaction.

The laryngoscope reveals a condition similar to that of the skin, the exanthem showing itself more or less clearly. Red spots project from the surface, giving it an irregular appearance. The process of resolution usually progresses without complication. Occasionally, however, œdema or ulceration occurs as a complication.

Extreme importance of being always prepared for suffocating laryngitis in measles. It is usually at the beginning of the attack that the larynx is liable to become inflamed. Some of these cases may be mistaken for ordinary laryngismus stridulus, but the latter does not present the constant character found in measles, and, even although there may be some relaxation in the severity of the symptoms, the patient will still show aphonia or marked hoarseness. Suffocating laryngitis usually occurs in young patients, mostly under three years of age. Sevestre (Jour. de Méd., Mar. 10, '99).

Variola and Varicella.—The laryngeal manifestations of variola are various. In some cases small pustules are observed; these may gradually develop into a necrotic process, leading to perichondritis and even œdema. The symptoms are those of acute laryngitis. The intensity of the local disorders varies with the gravity of the general disease, but, as a rule, the course is a benign one.

In varicella laryngeal symptoms are not as frequently observed as in variola, but they sometimes assume as serious proportions. Deglutition, phonation, and respiration may be seriously impaired, the latter resulting mainly from the smallness of the larynx in children.

Autopsy of a case of varicellous laryngitis in which there was found gangrene

of the edge of the epiglottis, a strip of slough on the free borders of the vocal cords. A crateriform erosion on the velamentous portion of the left vocal cord. A varicella-spot on the mucous membrane of the left pyriform fossa. Roger and Bayeux (*Presse Méd.*, Apr. 10, '97).

In varicellous laryngitis the symptoms are those of eroup. The specific character of the disease is very clear, there being small circular ulcerations on the vocal cords, and often on the epiglottis. Harlez (*Jour. de Méd.*, June 25, '97).

Scarlet Fever.—In this disorder more or less marked involvement of larynx is frequent. In the vast majority of cases, however, the cause of the trouble is benign, and resolution occurs along with the general malady. The exceptions inferred may at least simulate various grave disorders, such as diphtheria and membranous laryngitis. Œdematous infiltration is also occasionally witnessed, and likewise constitutes a grave complication. In all these disorders the tendency to ulceration is markedly increased, and, when this starts, it is checked with difficulty. Perichondritis and hæmorrhage owed to destruction of blood-vessels are always to be feared in such cases.

Erysipelas.—There is a form of acute laryngitis, closely associated with, if not an actual manifestation of, *erysipelas* of the larynx. This is a dangerous form, often accompanied by œdema, high fever, great hoarseness, and dyspnoea almost from the start.

Infectious phlegmon of the pharynx and the larynx should be differentiated from erysipelas. Dysphagia, albuminuria, splenic engorgement, and in many instances delirium cited as the special characteristic indications of the malady. P. Merklen (*Le Mercredi Méd.*, Nov. 12, '90).

Typhoid Fever.—The laryngeal complications of typhoid are to a certain degree typical in the fact that they are cir-

cumscribed in the great majority of cases. The parts that most frequently show erosions are the laryngeal surface of the epiglottis near the edge, the ventricular bands, and the upper part of the arytenoid space, the specific character of the complication being thus readily shown. The various ulcerative processes noted in scarlet fever are also occasionally observed in typhoid fever, the tendency to spread being equally marked. The destructive process may not only present itself during the progress of the general affection, but at some time after.

Catarrhal laryngitis, œdema of the glottis, perichondritis, may all be seen. The last-mentioned lesion may give rise to most wide-spread results in the direction of stenosis, besides its immediate dangers from necrosis of the cartilages and the like. From the intense prostration and apathy of the later period of typhoid these may go for some time unnoticed and progress untreated. The presence of Eberth's bacillus in the sputum noted and also in sections of the mucous membrane of the larynx in a fatal case of typhoid, showing that the laryngeal lesion is of a specific character, and not due simply to the general effects of the fever. The importance, in cases of typhoid in which there is any suspicion of laryngeal symptoms, of examination with the laryngoscope emphasized. Lueatello (*Gazzetta degli Ospitali*, No. 132, '93).

In post-mortem records of St. Bartholomew's Hospital of sixty-one cases of typhoid fever, fourteen showed loss of substance in the larynx. The larynx had not been examined; assuming that the larynx had been examined in all the remaining fifty-three cases, which is doubtful, ulceration was found in 26 per cent. of the fatal cases. These defects are situated generally over the tip and edges of the epiglottis and in the neighborhood of the processus vocalis. The lesions are caused by micro-organisms; there is the strongest evidence that these are the pyococci, and not, except rarely, the typhoid bacilli. Kanthack and Drysdale (*Jour. of Laryn.*, etc., Apr., '96).

When ulceration of the larynx is noted in typhoid fever it is not necessarily typhoid in nature. The ulceration in some of the larynges obtained at autopsies of persons dead from typhoid fever are found under the microscope to be of a tubercular nature. Jobson Horne (Jour. of Laryn., etc., Apr., '96).

Those forms, due to typhoid infection, which result in stenosis of the larynx, are apparently of rare occurrence in the United States than it is in Europe. Of 8 cases recently reported as occurring in this country two recovered completely, two partially (*i.e.*, they have yet to wear the tube) and four have died. From a study of the reported cases and from the experience gained with his own the writer recommends the following line of treatment: Early tracheotomy, with subsequent dilatation and finally intubation of the larynx. Mayer (Medical Record, July 25, 1903).

Pertussis.—In whooping-cough the laryngeal manifestations are sometimes quite marked, but they are not attended, as in other diseases, by ulcerative processes. The severe cough induced occasionally causes marked congestion of the interarytenoid space, accompanied, at times, by extravasation and localized hæmorrhage. Slight œdema is frequently observed. Diphtheria as a complication has been witnessed, though very rarely. The most annoying feature in connection with the larynx is a resulting hyperæsthesia of the interarytenoid space, which may persist indefinitely, the patient being subject to exacerbations of coughing when using his larynx any length of time. A dry, warm, or dusty atmosphere is also likely to cause considerable inconvenience. This sequel is especially apt to occur in adults.

Influenza.—The laryngeal complications of influenza generally occur in the cases in which symptoms affecting the upper respiratory tract are observed. There is the tendency to hæmorrhage;

ulceration is also occasionally observed. Spasmodic cough is also present, causing considerable distress to the patient by greatly increasing the intensity of the frontal cephalalgia. Œdema of the larynx is occasionally met with, but, as a rule, it does not assume grave proportions.

Laryngeal manifestations are frequent in influenza. Generally there is simply a catarrhal inflammation, but serious complications may occur,—ulcers, erosions, paralysis, œdema. Two cases of œdema witnessed in the Necker Hospital. The œdema affected the arytenoids and ventricular bands, and dyspnœa was marked; but not so great as to necessitate tracheotomy. Natier had seen two cases of influenza complicated with laryngeal œdema of the cords, which disappeared upon applications of nitrate of silver. Cartaz (Journal of Laryn., June, '93).

Typhus Fever.—In this disease the manifestations are similar to those in typhoid fever and the complications are also liability to ulceration, œdema, or pseudodiphtheria.

Schech includes under the name of "laryngitis exudativa" a series of affections of the laryngeal mucous membrane in which there is exudation with more or less fluid contained in vesicles or bullæ, or hyperæmia with swelling. In *miliaria* there are vesicles on the epiglottis and aryepiglottic folds, giving rise to the sensation of a foreign body. *Herpes* very seldom occurs alone in the larynx; there is usually an implication of skin or of mucous membrane.

Acute inflammation of the tongue, floor of the mouth, and larynx may be due to herpes. Two cases clinically indistinguishable from angina Ludovici, which after death were found to be associated with, if not due to, trichina spiralis and miliary tuberculosis, respectively. S. Mackenzie (Brit. Med. Jour., May 18, '94).

Herpes of the larynx only occurs as one of the localizations of herpetic fever; its

most frequent seat is on the posterior surface of the epiglottis and the region of the arytenoids. The herpetic vesicles are surrounded by an inflammatory zone. There is odynphagia, dysphonia, possibly dyspnœa. Brindel (*Revue de Laryn., d'Otol., et de Rhin.*, Mar. 15, '95).

Schech also groups under the same head *foot-and-mouth* disease (stomatitis epidemica) accompanied by more or less constitutional disturbance and by vesicles in the larynx, which break down into ulcers; *aphthæ*, which sometimes occur in the larynx in association with aphthæ of the mouth or vulva; *pemphigus*, which occasionally forms exudative swellings in the larynx, but the disease is rare in this organ. *Urticaria* also occasionally affects the laryngeal mucous membrane, and the symptoms depend upon its extent. *Lichen ruber planus* is more usually observed in the mouth and fauces than in the larynx. *Impetigo herpetiformis*, *erythema nodosum*, and *erythema multiforma* are rarely observed in the larynx.

Pathology.—Symptomatic laryngitis is ascribed to the penetration into the laryngeal tissues of micro-organisms, especially the streptococcus pyogenes, staphylococci, the pneumococcus, and bacteria coli communæ. The germs are thought to penetrate the deeper structures through minute abrasions of the surface or by way of the lymph-channels, the blood, etc. Neighboring inflammatory foci are especially prone to cause infectious disorders of the larynx.

The symptoms are marked from the onset of the disease. They develop very rapidly and are of the greatest severity. Frequently in a few hours after the earliest manifestation of the disease a hard swelling will be found between the arch of the lower jaw and the hyoid bone. The swelling spreads rapidly, soon involving the neck and face in a hard, dark-red, brawny induration. Respiration is soon impeded by involvement of the deep connective tissue of

the neck. The pharynx and larynx become involved, and attacks of acute dyspnœa with cyanosis supervene. The swelling may spread downward to the anterior mediastinum and on to the chest-wall. Inspection of the mouth, although unsatisfactory, due to fixation of the jaw, will disclose the sublingual tissue to be so œdematous as to push the tongue against the roof of the mouth. In the early stage the swelling is unilateral, but soon both sides become involved, and deglutition becomes difficult or impossible. Supervening the local condition a marked general sepsis occurs. G. G. Ross (*Annals of Surg.*, June, 1901).

Treatment.—The treatment of symptomatic laryngitis does not differ from that of acute laryngitis or œdema of the larynx when the local manifestations are such as to warrant assimilation with these disorders. As a rule, the laryngeal manifestations of infectious diseases are slight, but the possibility of complications in this direction should always be borne in mind, owing to the rapidity with which they may prove fatal when untreated.

Chronic Laryngitis.

Symptoms.—As a result of frequently repeated attacks of acute laryngitis, or of continued exposure of the larynx to conditions capable of maintaining a prolonged hyperæmia of the larynx, a chronic catarrhal process is developed. Exacerbations of hoarseness, a sensation of rawness and heat, and the presence in the laryngeal cavity of secretions—mucoid or muco-purulent—giving rise to a constant desire to “hem” constitute the main symptoms of this condition.

Chronic laryngitis is most frequently met with in singers. Hoarseness in these represents the most important symptom; it may be continuous or occur only after a few bars have been sung. This is usually accompanied by a feeling of local fatigue, heat, and constriction. The

voice is usually lowered in pitch and may be veiled, muffled, or complete aphonia may exist. Pain is sometimes complained of. Cough provoked by sensation of itching or pricking frequently occurs as a prominent symptom. Slight hæmorrhage and blood-expectoration are occasionally noted.

In some cases these symptoms present themselves upon the least exposure, disappearing after a few days. As the attacks are repeated, however, they become more resistant to therapeutic measures, and the local disorder becomes permanent symptomatically as well as pathologically. Hoarseness is then continuous. Warm weather, however, is apt to bring temporary relief.

The laryngoscopical appearances vary considerably, and are proportionate to the degree of active inflammation. The evidences of local hyperæmia are nevertheless always present, and vary from a slight arborescent and light pink tinge suggestive of congestion to a bright-red hue indicative of violent inflammation. The epiglottis is also congested, enlarged vessels coming over its posterior surface, while the aryteno-epiglottic folds appear thickened, the tumefaction involving the entire larynx in marked cases. The surface is irregular and sometimes quite bosselated. The general redness is not so marked as in some cases of acute laryngitis; it is apt to assume a brownish or violet coloration. The vocal bands are also more or less congested; the congestion may either be limited to a small portion of their surface or involve their entire area. Small masses of stringy cream-like mucous are frequently to be seen forming films when the glottis is opened.

Sometimes the vocal bands appear relaxed and their thickened edges do not seem to come accurately together, an elliptical opening being occasionally ob-

served between them. This want of parallelism is due to muscular paresis, affecting usually but one side.

Shallow abrasions of the epithelial covering are occasionally met with, especially in the interarytenoid space. Deeper ulcerations sometimes leading to perichondritis have been observed by various clinicians.

The secretions are sometimes very copious, especially when, in the latter part of an active exacerbation of vocal disability, the patient tries to use his voice. This condition is termed "*laryngorrhœa*" by some authors.

The terms "*dry laryngitis*" and "*laryngeal ozæna*" have been given to a condition occasionally met with, in which the secretion, besides being muco-purulent, is prone to adhere firmly to the mucous surfaces and to become partly desiccated in this situation. The dry crusts formed, by impeding the free passage of air, give rise to more or less dyspnœa, while the breath is rendered fœtid. Laryngoscopically examined, the larynx appears red and dry, with greenish crusts closely adhering to parts adjoining the vocal cords either above or below.

While chronic catarrhal inflammations of the larynx are not incurable, yet they can only be satisfactorily managed by taking a broad view of the etiology of the affection and treating mainly the causative factors. Leonard (Med. Rec., July 30, 1904).

Etiology.—In singers, officers, hucksters, etc., who are called upon to use the voice excessively, chronic laryngitis may occur as a primary affection, but in persons who do not use their vocal organs professionally, the primary cause can usually be traced to some disorder of the adjoining cavities, nasal, naso-pharyngeal, and pharyngeal. A dusty or smoky atmosphere may induce chronic laryngitis, but the other portions of the upper

respiratory tract are involved in the inflammatory process.

The rheumatic and gouty diathesis, gastric and hepatic disorders, the abuse of alcoholic beverages, and all the factors enumerated under the heading of ACUTE CATARRHAL LARYNGITIS may act as causative factors when exposure to them is prolonged.

Dry laryngitis has been ascribed to many affections. In some cases it is but a manifestation of a general atrophic process involving the mucous membrane of the upper respiratory tract and may thus be identified through the presence of Löwenberg's bacillus.

In the very few cases that I have met with, dry laryngitis, when not accounted for by a naso-pharyngeal affection or syphilis, was found associated with a gouty diathesis. The infraglottic space seems to be the favored region for the formation of the greenish crusts observed in this condition.

Chronic inflammatory disorders of the larynx are more frequently observed in men than in women, doubtless because the former are more exposed to the etiological factors outlined than the latter. Smoking and drinking is a prolific indirect cause, as stated, and these habits are most generally indulged in by the male sex. Chronic laryngitis can occur at all ages.

Case of chronic self-inflicted ulceration of the throat by means of nitrate of silver or nitric acid. F. Semon (Med. Press and Circ., Jan. 30, '94).

Chronic laryngitis may be divided into three classes, as follows: 1. Systemic, in connection with valvular disease of the heart, cirrhosis of the liver, alcoholism, gout, etc. These cases are but part of a large lesion, and little special attention need be paid to the local trouble in the larynx. 2. With nasal disease, which may act in three ways. By extension of the catarrh by continuity of surface, by irritation from the discharges, and by

mouth-breathing caused by nasal obstructions. In all cases the first indication is to treat the nasal lesion thoroughly. 3. In a small number of cases the inflammation is limited to the larynx.

The cases may also be classified as to the part of the larynx most affected as follows:—

1. *Laryngitis chronica superior*. As the upper part of the larynx contains much loose tissue, inflammation of the same is accompanied by considerable swelling. The vocal cords may be quite overhung by the false cords. Applications of a fine-pointed galvanocautery under cocaine and suprarenal anæsthesia have given good results. This form is often difficult to diagnose from tuberculous laryngitis.

2. *Laryngitis chronica media*. When the true cords are principally affected, mild cases can be cured by resting the voice and painting with a silver solution (30 grains to the ounce). Where the congestion is limited to the anterior portions of the cords, it is advisable to give antisyphilitic remedies, even in the absence of history or other symptoms of syphilis. In singers faulty voice-production must be rectified before they again take up their vocation. Hæmorrhages are not very infrequent, due to enlarged vessels on the cords. If the cords are much swollen potassium iodide should be exhibited.

3. *Laryngitis chronica inferior*. The subglottic regions are often neglected, owing to difficulty of inspection. Thorough cocaine anæsthesia of the larynx renders it easy to inspect and treat these regions, and a methodical treatment (too often neglected) of the subglottic space will assist materially in the cure of obstinate cases. N. V. Haring (Brit. Med. Jour., Aug. 30, 1902).

Pathology.—Dilatation of the blood-vessels, through paresis of the vasomotors, interstitial infiltration which may lead to hypertrophy and thickening, are the main pathological features attending a case of uncomplicated chronic pharyngitis. The superficial vessels tend

to become varicose, tortuous veins being observed, especially in regions—such as the ventricular bands, the interarytenoid membrane, etc.—where the tissues are lax. The glandular elements take an unusually active part in the inflammatory process of some cases, constituting what has been termed a “glandular laryngitis.” Rounded sessile projections, differing but slightly from the neighboring tissues in color, have been called “chorditis tuberosa” or “trachoma of the larynx,” but these are probably but mere localized hypertrophies, strictly associated with chronic laryngitis. The tissues beneath the vocal bands often take part in the inflammatory process.

Treatment.—The association so frequently noticed between chronic inflammation of the naso-pharynx and of the larynx renders it imperative always to examine the entire upper respiratory tract when continued hoarseness is complained of. This is further supported by the fact that cases are often met with in which no benefit whatever is derived from treatment limited to the larynx until attention is given to the naso-pharyngeal surfaces. Cleanliness of these parts, in fact, may be considered a *sine quâ non* of success in 90 per cent. of cases. The same remarks may be applied in connection with concomitant disorders of other organs.

In many cases the laryngeal inflammatory process is sustained by disorders of gastric, hepatic, and renal systems, all of which require close scrutiny.

Attacks of hoarseness in professional vocalists are often but exacerbations of chronic laryngitis, a deficiency of lubrication of the vocal bands being the main local factor. This condition may successfully be combated by administration every two hours of 10 grains of ammonium chloride in a tumblerful

of water, and the topical use of warm sprays of a saturated solution of potassium chloride at the same intervals. The doses are so managed that the last one should be taken at least about three hours before a performance. This avoids exposure during the subsequent stage of perspiration. A lozenge containing 10 grains of the ammonium chloride taken between the acts is of benefit in many instances.

The following formula is useful in chronic laryngitis:—

R Thymol, 15 grains.

Eucalyptol, 20 grains.

Creasoti, 2 drachms.

Ol. pini sylvestri, 4 drachms.

Ol. gaultheriæ, 1 drachm.

M. Sig.: For inhalation use from 2 to 5 drops. C. C. Rice (Amer. Med. Compend, Feb., '99).

The characteristic congestion of this affection, and even the superficial erosions frequently encountered, will often yield to a detergent spray of bicarbonate of sodium, borate of sodium, and salicylate of sodium, 3 grains of each to the ounce of water, applied copiously three times a day to the entire upper respiratory tract—the nose, the pharynx, and the larynx.

In stubborn cases occurring in singers, spraying with a 2-per-cent. solution of lactic acid, used frequently,—eight to ten times daily,—recommended. Hygienic measures and tonics form important adjuvants. Massei (La Sem. Méd., No. 32, '94).

After cleansing, even the slight erosions should be touched with stronger agents. Solutions of nitrate of silver are most effective, but demand considerable dexterity if laryngeal spasm is to be avoided. The laryngeal forceps must be used, its tip, covered with a cotton pledget, being gently applied to the mucous membrane. Resorcin is an effective agent in a solution containing 7 grains to the ounce. A 20-grain solution

of iodoform in benzoinol is a very effective remedy, but the difficulty of keeping the atomizer free when benzoinol is used renders its employment obnoxious to the patient. The infraglottic region should not be overlooked when local applications are made, the patient being also directed to inhale deeply when the atomizer is being used.

Iodol might be substituted, but it possesses irritating properties when used in strong solutions: 5 grains to the ounce is the maximum strength that an inflamed larynx can stand with benefit. Solutions of sulphate of zinc, sulphate of copper, and alum, 5 grains to the ounce, may be substituted should the other agents recommended not be obtainable.

Mild cases, especially those in which there exists involvement of the infraglottic tissues, are greatly benefited by benzoate of sodium. Exacerbations are sometimes quickly stopped with 5-grain doses administered every three hours, in addition to the local measures recommended.

In certain cases the vocal bands will present, during an exacerbation of the catarrhal process, the greatest amount of congestion as compared with other parts of the laryngeal cavity. Their mucous membrane, as stated, appears thickened, bosselated, and very red at the edge, the voice being coarse and screechy when an effort to sing is made. This form of chronic laryngitis is characterized by frequent exacerbations, and finally costs a singer his voice unless he stops singing for a while and undergoes active local treatment. Labus, of Milan, proposed flaying of the vocal bands in these cases, and obtained several satisfactory results. After thoroughly anæsthetizing the larynx he tore off with a sharp square-tipped laryngeal forceps the

superficial layer of membrane of the vocal bands—a procedure followed by slight hæmorrhage, a few days' aphonia, and final recovery of the voice. I have substituted applications of chromic acid to destroy the thickened mucous layer, obtaining equally satisfactory results. Cocaine causing a copious flow of lubricating fluid from the lateral tissues when applied to the larynx for a certain length of time, it is necessary to use the acid as soon as possible after the application of the 25-per-cent. solution, the strength it is advisable to employ.

The chromic acid, fused by heat to the end of a covered probe, such as MacCoy's, immediately before the anæsthetic, is then applied to the surface of one of the vocal bands, while the patient, having been told to make a sound, brings both bands into apposition. This enables the operator to avoid cauterization of their edges—an important point in the preservation of the voice, especially in women. But little if any disturbance follows, and after a few days hardly a trace remains of the cauterization, except a spot presenting less redness than the surrounding parts. The applications should be made twice a week until all traces of localized congestion or bosselated areas have disappeared.

When laryngitis is aggravated by gastric, hepatic, or intestinal disorder, especially in drinkers and smokers, attention to these conditions should, of course, form an important part of the treatment. In patients who smoke considerably the congestion is often maintained simply by the irritating action of the air contaminated with smoke. Sitting in a smoking-car or in a room in which others are smoking is, therefore, as bad as if the patient himself were smoking.

In dry laryngitis, attention to the naso-pharyngeal disorder also forms an

important part of the treatment. Detergent and disinfecting sprays are of great use, but must be employed for a considerable time. Chlorate of potassium in the form of a saturated solution, and permanganate of potassium, 3 grains to the ounce, are effective agents, while listerin and water, equal parts, may also be recommended, to alternate with either. Iodide of potassium, administered internally, 5 grains three times a day in half a glassful of water, tends to increase the laryngeal secretions, as it does those of the nasal cavities, especially in persons who are sensitive to its physiological effects. When a gouty or rheumatic diathesis can be traced, colchicine or salicylate of sodium are indicated. (See GOUT and RHEUMATISM.)

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LARYNX, SYPHILIS OF. See TUMORS OF LARYNX.

LARYNX, TUBERCULOSIS OF. See TUBERCULOSIS OF LARYNX.

LARYNX, TUMORS OF. See TUMORS OF THE LARYNX AND LUNGS.

LEAD.—Lead (plumbum) is not official, as it is not employed in medicine. Lead combines with oxygen forming oxides, one of which (the yellow) is official (plumbi oxidum, U. S. P.), with the acids and with chlorine, iodine, bromine, etc., forming salts. Of these salts the acetate is the only one used internally to any extent, although the iodide is rarely used for alterative purposes. The acetate of lead (sugar of lead) occurs in efflorescent, colorless, shining transparent prisms, or flat crystals, having an acetous color and a sweet, metallic taste. It is soluble in $2\frac{1}{3}$ parts of cold, and in $\frac{1}{2}$ part of boiling water; in 21 parts of cold, and

1 part of boiling alcohol; in 3 parts of chloroform, and in 5 parts of glycerin.

Carbonate of lead (white lead, or ceruse) occurs in perfectly-white masses or powder. It is insoluble in water, but soluble in acetic acid and dilute nitric acid.

Iodide of lead occurs in a golden-yellow powder and is insoluble in cold water, but soluble in 200 parts of boiling water and in solution of the alkalies and of the iodide of potassium.

Nitrate of lead occurs in white crystals, and is soluble in 2 parts of water.

Oxide of lead (litharge) occurs in a yellow to yellow-red powder and is insoluble in water, but soluble in acetic and nitric acids.

The above salts and their preparations are the only ones official in the United States Pharmacopœia.

Preparations and Doses.—Plumbi acetatis, 1 to 5 grains.

Plumbi iodidum, $\frac{1}{4}$ to 2 grains.

Liquor plumbi subacetatis.

Ceratum plumbi subacetatis.

Liquor plumbi subacetatis dil.

Plumbi carbonas (used externally).

Unguentum plumbi carbonatis.

Unguentum plumbi iodidi.

Plumbi nitratis (used externally).

Plumbi oxidum (used externally).

Emplastrum plumbi.

Emplastrum resinæ.

Emplastrum saponis.

Unguentum diachylon.

Physiological Action.—Unless a concentrated solution be used, lead applied locally acts as an astringent by inducing contraction of the capillaries. Hence its beneficial actions in inflammation. Concentrated solutions are irritating, on the contrary, and may induce inflammation.

Taken internally in therapeutic doses, lead also acts as an astringent, and diminishes the secretions of the gastro-

intestinal tract. Beyond these effects the manifestations are those of poisoning. The nitrate, the subacetate, and the acetate are poisonous in the order named.

Acute Lead Poisoning.—Acute poisoning is rare, but may occur when a soluble salt (notably the acetate) is taken in poisonous amounts (not less than 1 ounce is necessary to produce serious effects). The symptoms are a sweet, metallic taste in the mouth, pain in the epigastrium, and vomiting of white milky-looking liquids, or white curds, mixed with food if any food was present in the stomach. The white color indicates the presence of chloride of lead, formed by the action of the hydrochloric acid of the gastric juice. Later, irritation of the intestinal tract occurs with an increase of pain, and either diarrhoea due to gastro-enteritis or, in some cases, obstinate constipation is noticed. The stools are generally black in color (from the action of the intestinal sulphuretted hydrogen-gas, which forms a sulphide). The pulse becomes rapid and tense, but later weak and compressible. The face is anxious and may be either pale or lived. Excessive thirst is present, with cramps in the calves of the legs or muscular twitchings. In fatal cases coma, epileptic spasms, or collapse ensues. Up to the point of the affection of the nerve-centres (spasm, coma, or collapse) the prognosis is good; beyond this it is unfavorable.

Treatment of Acute Poisoning by Lead.—If there is reason to believe that any of the lead-salt is present in the stomach, the stomach-siphon may be used. Any soluble sulphate (Epsom or Glauber's salts) will decompose the lead salt and form an insoluble sulphate of lead; if used in excess the salts mentioned will act as purges and wash out the offending matter. Cramp and spasms may be re-

lieved by hot applications to the abdomen and to the extremities. Pain may be relieved by opiates.

Chronic Lead Poisoning.—The sources of poisoning by lead are very numerous. Occupations in which lead is employed, however, predominate as causative factors, and painters, white-lead-paint mixers or grinders, wall and other paper-mill operators, glaziers, etc., are the victims in the great majority of cases.

Adulterated foods and liquids represent the main sources of poisoning among those whose occupations do not involve exposure. Cooking utensils painted white inside, bread made of flour contaminated with a lead-filled grindstone, cake colored with lead bichromate to avoid the use of eggs, imperfectly burnt pottery, fruit-jars glazed with lead, etc., are as many media through which lead can reach the system. A fruitful cause of poisoning is pure water when conveyed through lead pipes, the lead being slowly dissolved. When, however, the water contains even a minute quantity of lime-salts, an insoluble coating is formed which arrests all further action as soon as the inside of the pipes is completely covered. Cosmetics, hair-dyes, and face-powders occasionally cause plumbism.

Constitutional Effects.—Slow absorption of lead, whether due to industrial, accidental, or criminal causes, mainly affects the muscles, the peripheral nerves, the liver, and the kidneys. Pallor of muscles and mucous membranes is an early result, fibrosis occurring in advanced cases, accompanied by degenerative changes in the nerve-endings. These changes become less marked as the spinal centres are approached, the spinal cord being usually normal. The brain, however, is not so exempt from morbid

changes. All the manifestations of saturnine toxæmia are pathologically based upon the changes here outlined.

A blue line along the margin of the gums, at the base of the teeth, is an important sign. It is especially marked in persons who are not cleanly as regards their mouth.

Lead Colic.—This symptom is most frequently met with in painters who mix and use white lead. The abdominal cramp is usually very severe, the muscles being rigid and contracted. A peculiarity of the pain is the fact that the location of its greatest intensity is around the navel. It occurs by exacerbations, the accesses being often accompanied by nausea or vomiting. The tongue is white and contracted and there is thirst—sometimes intense. Constipation is the rule. The face is pale or jaundiced.

After continuing for a period varying from a few hours to several days, the symptoms gradually recede and the access ceases. When no treatment is resorted to and the causative occupation is continued, the attacks return frequently, and death may finally occur through cachexia or anæmia, paralysis of the respiratory muscles, cirrhosis of the liver, or through some intercurrent disorder.

Five cases of lead colic treated by injecting 1 pint of normal salt solution under the skin of the abdomen; in all the cases muscular pain soon disappeared, and, instead of the constipation, a beneficial diarrhœa set in the next day, which ceased of its own account a couple of days later. Deléarde (University Med. Mag., Jan., '99).

Case in which erythrol-tetranitrate was used with benefit in lead colic. The arterial tension was high, the pulse hard, and the sphygmographic tracing characteristic. The remedy was administered in $\frac{1}{2}$ -grain dose. With the reduction of arterial tension there was a cessation of pain, and the patient slept. This was repeated twice with similar

results. Mattirlo (Gaz. degli Osped. e delle Clin., No. 63, 1901).

Atropine used in several cases of colic due to lead intoxication with favorable results. The extract of belladonna in doses of $\frac{1}{4}$ grain (0.015 gramme) was first frequently given, but preference was then given to the alkaloid in doses of $\frac{1}{60}$ to $\frac{1}{20}$ grain (0.001 to 0.003 gramme) given hypodermically. Prompt relief generally follows except in cases in which opium has been previously administered. In such cases even enormous quantities of atropine remain ineffectual, being neutralized by the opium. No untoward effects were observed. Adolph Weber (Münchener med. Wochen., xlix, No. 17, 1902).

Lead Encephalopathy.—In some cases marked cerebral symptoms occur. These may develop gradually or quite suddenly, violent headache, vertigo, tinnitus, strabismus, and other cerebral manifestations presenting themselves. In the cases developing slowly the symptoms tend to demonstrate paresis of various systems, central and peripheral, the most characteristic of these being wrist-drop, due to paralysis of the extensor muscles of the forearm. Vertigo, loss of memory, disturbances of the special senses, cerebral palsies, hemiplegia, and monoplegia have also been noted. Alteration of the brain-structure, its arteries and meninges, is usually found post-mortem.

Convulsions, amaurosis, delirium, and coma, or a condition simulating epileptic fits, hallucinations, mania, melancholia and hysteria are not infrequently met with. Saturnine epilepsy is a dangerous manifestation and usually ends in death.

General Disorders due to Lead.—Lead may act as an etiological factor in many diseases. Its rôle as such is fully considered in the articles upon the various affections, and do not require repetition here.

Treatment of Chronic Poisoning.—The indications are to remove the causes, to

remove the poison already in the body, and to treat the lesions or tissue-changes produced by the poison. Frequent doses of Epsom salts will not only relieve the colic, but will convert any lead present in the gastro-intestinal tract into an insoluble sulphate, and expel it from the body. Jalap and calomel, guarded with opium to prevent griping, and alum in 2-grain doses with opium or morphine, are suggested as valuable remedies. When cerebritis is present a blister may be applied to the nape of the neck, and revulsions, amyl-nitrite, and sweating (by pilocarpine) may be tried. To eliminate the lead our sheet-anchor is the iodide of potassium, given in doses of 10 to 20 grains three times daily. A double soluble salt (potassic iodide of lead) is formed, which may be excreted by the kidneys through the urine and by the liver through the bile. Paralysis is an indication for the exhibition of strychnine in large doses, during treatment with potassium iodide (given separately), and the employment of massage and electricity. The induced (faradic) current should be employed if the muscles react; if they do not, galvanic current is indicated. When no reaction to the direct (constant or galvanic) current is observed, the paralysis is seldom recovered from. In all cases removal from the source of poisoning should be insisted upon.

Therapeutics.—Lead is never given to affect the system at large; the constitutional effects are of no use in medicine. It is used only for the local effects,—astringency, etc.,—which differ with the form used.

GASTRO-INTESTINAL DISORDERS.—Acetate of lead is an astringent remedy often used to arrest hæmatemesis, especially when due to gastric ulcer. It is also recommended in chronic gastritis

with pyrosis and gastralgia. In diarrhœa of phthisis, choleraic diarrhœa, and in summer diarrhœa a few grains of the acetate with a small dose of opium or morphine relieves speedily. In acute and chronic dysentery an enema of 4 grains of the acetate, $\frac{1}{2}$ grain of morphine acetate, and 1 ounce of warm water will relieve the tenesmus and reduce the frequency of the stools.

In cholera and the purging from dysentery and typhoid fever a few grains of the acetate may be combined with starch and a moderate dose of opium, and be given in enema. The acetate may also be combined with opium in suppository for checking various forms of diarrhœa and for the relief of irritable conditions of the rectum.

EXTERNAL APPLICATIONS OF LEAD.—An excellent application to burns is white-lead paint (carbonate of lead and linseed-oil), especially if the surface is not very large and there are no fears of a dangerous amount of absorption. The official ointment of the carbonate of lead may be preferred.

Lead lotion (liquor plumbi subacetatis), diluted with 3 or 4 parts of water, is a good application to eczema, where there is much weeping. It is also valuable when combined with laudanum (lead-water, 4 parts; laudanum, 1 part; water, 16 parts) as an application to inflamed surfaces, bruises, sprains, fractures, blisters, scalds, excoriations, and fissured nipples.

The acetate of lead is also an excellent application for the dermatitis produced by poison-ivy (*Rhus toxicodendron*), as the lead precipitates the non-volatile oil of the poison. For this latter purpose Hare advises that 8 grains of lead acetate should be dissolved in a pint of alcohol and used as a wash; cooling applications should follow, but ointments

should be avoided, as they dissolve the poisonous oil and spread the irritation.

Lead acetate is a useful application. In pruritus pudendi the lead-water, or cerate, may be used. Helva recommends the application of equal parts of lead plaster and linseed-oil for sweating feet. They should be applied on linen and wrapped around the feet every third day. Nitrate of lead is used, in powder, in the treatment of onychia.

In gonorrhœa and leucorrhœa a solution of lead acetate (3 or 4 grains to the ounce of water) may be used as an injection. Lead preparations should never be used in eye-lotions, as they are apt to deposit the lead in the tissues of the cornea and leave permanent white patches, especially if ulcer of the cornea is present.

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LENS, DISEASES OF.

Anomalies of Position.—Anomalies of position are always the result of changes in the zonula of Zinn.

Classification.—Cases of dislocation of the lens are commonly divided into two groups: in one of which the lens has completely left the fossa patellaris (luxation, or complete dislocation), while in the other it still remains partly within this cavity (subluxation, or partial dislocation); but as it is usually only a matter of time for cases in the latter group to find their way into the former, this distinction only marks a stage in the history of the case.

A more convenient and comprehensive classification can be made on an etiological basis.

Dislocations of the lens are either *congenital* (ectopia lentis) or *acquired*.

The latter group may be thus divided:—

1. Traumatic cases, in which the lesion varies in degree: (a) There may be a partial displacement, the lens being caused to rotate on its axis, or pushed sideways, thus assuming an oblique position, or a position with its edge in the pupil; or it may be displaced sideways *and* rotated. (b) It may be completely dislocated into the anterior chamber. (c) It may be completely dislocated into the vitreous chamber. (d) It may pass through a rent in the sclerotic, and lie under the unbroken conjunctiva: subconjunctival dislocation. (e) It may pass through a rent in the conjunctiva. (f) It has been found beneath Tenon's capsule.

2. The lens may escape from the eye at the moment of rupture of the floor of a large corneal ulcer: a more common incident in the cases of ophthalmia neonatorum than in any other form of disease.

3. It may be dragged out of position by iridic adhesions when the iris is stretched or rendered tense by the occurrence of peripheral staphyloma.

4. It may be pushed out of position by intra-ocular tumors.

5. Its displacement may be spontaneous.

Ectopia lentis seems to depend upon imperfect or incomplete development of the zonula, and, as this developmental failure occurs especially along the line where closure of the ocular fissure takes place, the more perfectly developed fibres at the upper part drag the lens in their direction. Consequently congenital displacements are almost always directly or obliquely upward. They are also usually symmetrical, and are not infrequently accompanied by coloboma of the lens, which, moreover, is apt to be undersized and thicker than normal.

In accordance with the above theory, dislocation of the lens is occasionally as-

sociated with coloboma of the iris, ciliary body, and choroid.

Case of double congenital dislocation of the lens in a boy 7 years of age, who was also partially amblyopic. The lens in each eye was tilted upward, slightly backward, and inward. No other structural changes could be detected. Conclusions that: (1) congenital ectopia lentis is usually double; (2) it is a congenital malformation, the cause of which is not yet positively established; (3) amblyopia and ametropia are always concomitant conditions, and that the majority of cases, so far reported, sustain the theory of heredity as the primary cause. Friebis (*Jour. Amer. Med. Assoc.*, Sept. 3, '92).

Series of lenses, 8 in number, in which the nucleus was not central, but lay close to the posterior capsule, either at the posterior pole or between it and the equator. In all the anomaly must have been due to a developmental disturbance. In some the outline of the lens was normal; in 5 others there was a posterior lenticonus. In 3 of these latter the conical ectasia of the lens-surface was formed by the displaced lens-nucleus, which was actually in contact with the capsule; in the other 2 this was not the case, the lens-fibres lying quite regularly on the little cone. The anterior section of the lens was in all cases normal. Only in 1 case did the lens-capsule, much thinned, cover the lenticonus. C. Hess (*"Bericht der Ophthal. Gesell."*, Heidelberg, '96).

Dislocation of the lenses observed in five children of a family of seven whose mother was similarly affected. In none of the cases was the dislocation upward. Miles (*Annals of Ophth., Otol., and Lar.*, July, '96).

Five cases of congenital bilateral dislocation of the crystalline lens in three successive generations. In all the dislocation was upward or upward and outward. E. T. Parker (*Phila. Med. Jour.*, July 16, '98).

A case is on record in which the coloboma of the iris was upward, there being a subluxation of the lens downward.

Although at first partial, congenital dislocation often becomes complete,

through degeneration and stretching of the fibres of the zonula; the lens then becomes movable to a degree which varies greatly, not only in the vitreous humor itself, but it may even pass backward and forward through the pupil: a condition described by Heyman under the title of "spontaneous motility of the lens."

So long as a congenital dislocation of the lens remains incomplete, there is no special tendency toward the formation of cataract; but when it becomes complete, and freely movable in the eye, the impairment of nutrition thereby involved leads more or less rapidly to its opacification. Occasionally a lens dislocated into the vitreous will remain clear for years.

Of all cases of dislocation of the lens, those of traumatic origin are, by far, the commonest. The traumatism usually consists of a blow by a blunt instrument, such as the fist or a stone, upon the eyeball; but concussion from a blow upon the side of the head may have the same result. Dislocation is more apt to occur when the vitreous is fluid: a condition which may be accompanied by degenerative changes in the zonula, in old age, and in sclerectasia anterior.

Traumatic luxation of the lens into the anterior chamber usually occurs when the patient is bent forward, the centre of the cornea being struck at that time. When the blow is nearer the periphery the luxation takes place in the direction of the force applied. Dujardin (*Jour. des Sciences Méd. de Lille*, Nov. 13, '91).

Traumatic dislocations present every variety and degree, from the slightest lateral displacement or rotation to complete expulsion of the lens from the eyeball.

Lens in an eye removed on account of a penetrating wound found to be dislocated between the ocular conjunctiva and the sclera, where it had become incapsulated in a mass of inflammatory exudate.

Wescott (*Annals of Ophthalm. and Otol.*, Jan., '93).

Two instances of traumatic dislocation of the lens into the vitreous, occurring in individuals both of whom had met with a similar accident in the opposite eye some years previously. Noyes (*N. Y. Eye and Ear Infirmary Reports*, '94).

The traumatism that is the immediate occasion of the displacement is often the cause of other ocular lesions, which may, for a time, obscure the diagnosis, and render prognosis more uncertain than would otherwise be the case. The dislocation of the lens may, indeed, be by no means the most important lesion produced. It is common to find hæmorrhage in the anterior chamber immediately after the injury, the full extent of which cannot be ascertained until absorption has taken place: or we may find dilatation and immobility of the pupil, hæmorrhage into the vitreous, or rupture of the choroid, and—especially in myopic eyes—detachment of the retina. In greater degree of violence the eyeball may be ruptured, usually in the sclera just behind and concentrically with the sclero-corneal junction, and through this rupture the lens—with the iris, choroid, retina, and vitreous—may escape.

Case of traumatic dislocation of the lens, followed by symptoms of fulminating glaucoma. Patient made a good recovery after extraction of the lens. Saunders (*Brit. Med. Jour.*, Mar. 2, '89).

Absorption of a crystalline lens that had been luxated into the vitreous during an operation upon the eye for glaucoma. Case occurred in a boy. All children have remarkable tolerance for that which would cause glaucoma in adult eyes. Chacon (*Gaceta Méd. de Mexico*, June 1, '92).

Spontaneous dislocation of the lens may take place while its transparency remains unimpaired, but it seems to occur more commonly when the lens has become cataractous, and more especially when the cataract has been allowed to

progress to a condition of hypermaturity (Morganian cataract). Although in some cases the displacement occurs without any evident immediate exciting cause, in many the acts of coughing or sneezing determine it. Gunn in 1895 reported a case of quite spontaneous symmetrical displacement of the lenses in a man aged 76. Three months before it failed a recorded examination showed vision, with refraction corrected, to be $\frac{6}{6}$ in each eye. Three months after failure both lenses were found displaced downward, their upper edges being visible just within the margin of the dilated pupil, one lens still remaining clear, the other having become opaque. Corrected vision in each eye, $\frac{6}{6}$. Fundus normal. It is hardly necessary to point out that old age constitutes the main predisposition to spontaneous dislocation of the lens, the immediate pathological factor being an atrophy of the fibres of the suspensory ligament: a condition described by Wedl and Bock as "senescence of the zonula."

Symptoms; Appearances; Vision. —

Any change in the position of the lens destroys the normal relations between it and the iris, the latter losing its support partially or totally, according to the degree of the displacement, or being unduly pressed forward or backward, or distended, according as the lens is tilted against portions of the posterior surface of the iris, dislocated into the anterior chamber, or fixed in the pupil itself. When the dislocation is incomplete the anterior chamber is deeper at the point vacated by the lens, and the iris of the same region is tremulous on quick movements of the eyes or head. In the slightest degrees of dislocation a slight tremulousness of one portion of the iris may constitute the only physical sign of the lesion, but is an absolute indication that the iris no longer rests on the anterior

capsule of the lens. The history of injury and the condition of vision will be necessary to lead to a correct diagnosis.

Increased depth of one portion of the anterior chamber may be accompanied by increased shallowness of another, from tilting forward of some portion of the lens against the iris and ciliary body: a relation which may result in setting up a condition of glaucomatous tension and form a very important factor in the progress of the case.

By employing focal illumination the edge of the lens can be seen in the pupil, which, however, usually requires to be dilated for this purpose. The lens itself will appear as a delicate gray compared with the pure black of the aphakic portion of the pupil, and its edge will appear luminous on account of the total reflection which the rays of light entering the marginal portions of the lens from the front undergo at its posterior surface; for at the edge of the lens they strike this posterior surface very obliquely.

With the ophthalmoscope, on the other hand, the edge of the lens appears black, for the same reason, the light coming into this portion of the lens from the fundus being reflected back into the eye.

When there is complete dislocation of the lens there will be an absence of the catoptric lenticular images. The lens itself when opaque may be visible through the pupil with the naked eye. As a rule, however, examination with the ophthalmoscope is necessary for its detection. It may be connected with the fundus or freely movable in the fluid vitreous (*cataracta natans*).

There is now more marked and general tremulousness of the whole area of the iris on quick movements of the eyes and head, with an abnormally, but uniformly, deep anterior chamber.

When once seen there is no difficulty in determining the nature of the floating body, on account of its shape and size and the fact that no other condition occurs with which it is possible to confound it.

When the lens is displaced into the anterior chamber its appearance is characteristic, its margin having a golden luster due to total reflection of light, making it look like a large drop of oil in the anterior chamber, which is much deepened, especially at its lower part. The lens assumes, moreover, a more spherical form than when *in situ*, on account of the loss of the compressing influence of the fibres of the suspensory ligament and choroid, etc. The irritation it sets up often causes a contraction of the pupil behind it.

In case of old, traumatic, dislocated, cataractous lens the central half of the pupillary quarter of the iris was altered in color and in brilliancy, while the ophthalmoscope revealed an alternate free transmission of the choroidal reflex and intercepting radial lines of iris-stroma. This latter points to a previously-existing radial muscular mechanism in the once healthy iris. Symon (*Australasian Med. Gaz.*, July 15, '92).

Condition of Vision.—Sight is always impaired to a greater or less extent. In partial dislocation, vision is affected, because rupture of the fibres of the suspensory ligament destroys the power of accommodation, and, at the same time, by permitting increase in the convexity of the lens, makes the eye highly myopic. Moreover, the tilting of the lens on its axis induces a variable amount of astigmatism, regular and irregular, lateral displacement having a similar effect.

In higher degrees of displacement, where the edge of the lens lies across the area of the pupil, not only is there a higher degree of visual failure, but there is also diplopia, two blurred images being seen. This is due to the fact that the

edge of the lens acts as a prism, and causes the rays of light entering the eye through it to be deviated in the direction of the dislocation, while those entering the aphakic portion of the pupil are unchanged in direction except in so far as they are made to converge and form an indistinct image on the retina.

Case of double dislocation, one upward, the other downward, with atrophy of the zonula. There was so-called monocular triplopia from a double image formed by the displaced lens, joined to a third image made by the media without the lens. Heddaeus (*Zehender's klin. Monats. f. Augenh.*, May, '88).

Considered, therefore, with regard to that portion of the pupil still occupied by the lens, the eye is myopic, and the image formed by the light-rays passing through it can be cleared to a greater or less extent by concave sphero-cylindrical lenses. With regard to that part from which the lens is absent, the eye is highly hypermetropic, and its image can be made clear by the aid of a convex spherical glass, and such a cylinder as is necessary to correct the corneal astigmatism. In a later stage vision may be further impaired by the development of opacities in the lens.

When the lens is completely dislocated into the vitreous chamber, and no complications have arisen, vision resembles that of an eye after cataract extraction, and the condition is exactly similar to that brought about by the operation of reclinatio, or couching.

The patient regains good vision with the aid of strong convex lenses, which have to be adjusted for distance, and also for the near point at which it is desired to read or work.

But in many of these cases complications arise which prevent perfect vision from being attained, or in course of time bring about its impairment in varying

degree. Thus, iridocyclitis may arise and destroy vision and even set up sympathetic disease in the fellow-eye. Or glaucomatous tension may occur, with the same result, so far as sight is concerned.

Four cases of spontaneous luxation of the lens, two of which were congenital. In one the luxation was bilateral. In three instances the lens had to be extracted, after years of quiet, upon account of violent glaucomatous attacks. Armaignac (*Jour. de Méd. de Bordeaux*, June 23, '95).

Case of secondary glaucoma following partial dislocation of lens; removal of lens; cessation of all pressure-symptoms. Oliver (*Wills Eye-Hosp. Reports*, vol. i, p. 1, '95).

Case in which a lens dislocated into the vitreous during a cataract-operation set up so much sympathetic disturbance six months later that enucleation was necessary. K. Hoor (*Wien. med. Woch.*, Aug. 22, '96).

Progress and Results. — Congenital dislocations are always incomplete, and the lens shows no special tendency to become opaque: good evidence that its nutrition is unimpaired. In some cases, however, the displacement increases, and complete dislocation into the vitreous or anterior chamber, or alternately into each, finally occurs. The latter condition is predisposed to by abnormal smallness of the lens: a common characteristic in cases of ectopia, which permits its easy passage through the pupil. When this state of complete luxation has been attained, the lens-substance is liable to deteriorate and become opaque. Striking against portions of the uveal tract the freely-movable lens may set up iridocyclitis, and disorganization of the eye and destruction of vision result. Or, as previously stated, secondary glaucoma may become established and finally lead to blindness.

In two cases, father and daughter, seen

in the practice of the writer, the father, aged 55, had opaque lenses freely floating in the vitreous, and sometimes passing through the pupil into the anterior chamber, with occasional glaucomatous attacks, always relieved by paracentesis. The daughter presented typical examples of ectopia lentis, both lenses being stationary and quite clear. Good vision was obtained with convex lenses.

Although there are cases in which a small lens may pass freely through the pupil, as a rule, a lens dislocated into the anterior chamber sets up violent inflammation. The irritation caused by its pressure on the anterior surface of the iris excites contraction of the pupil and iritis, which fix it firmly in position. Or a few white spots indicate the presence of adhesions between the lens and cornea, caused by inflammation of the latter. There is glaucomatous tension and rapid extinction of sight. As a result of the increased tension, ectasia of the anterior part of the sclerotic occurs, and a general enlargement of the eyeball.

Spasm of the sphincter iridis, just referred to, may occur while the lens is in the act of passing through the pupil. There then arise violent inflammatory glaucomatous symptoms.

In a case in which dislocation of the lens into the vitreous occurred as one of the results of the lodgment of a small piece of steel in the eye, the lens was found, after enucleation on account of persistent pain due to absolute glaucoma, to be completely opaque and *black*. The source of the pigment was quite evident, for the choroid was apparently entirely devoid of it. The foreign body was encysted in fibrous tissue attached to the retina near the equator. The enucleation was performed about twenty-five years after the injury, the eye having been blind for many years.

Treatment.—When no symptoms other than impairment of vision exist, suitable glasses may be prescribed; but when one eye only is the subject of dislocation, the other being normal and of good visual acuity, the patient will get on better without a correcting glass, depending on the good eye for clear vision. In cases of subluxation, the margin of the lens lying in the pupil, the kind of lens ordered depends upon whether better vision can be obtained by correcting the portion of the pupil containing the lens, the myopic area, or the aphakic, hypermetropic area. This can, of course, only be ascertained by actual experimentation.

Sometimes better vision can be obtained by enlarging the aphakic portion of the pupil by a small iridectomy. Other things being equal, this portion is to be preferred for correction on account of the greater size of the retinal images so obtained.

When the dislocation is complete, the lens being in the vitreous, the case is precisely similar from a refraction standpoint to one of aphakic after cataract extraction. Under all conditions two pairs of glasses are required: one for distance and another for reading or working distance.

But in many cases other symptoms besides disturbances of vision are present at an earlier or later stage in the case. In cases of partial dislocation pressure of the lens against the ciliary margins of the iris and the ciliary body may set up glaucomatous symptoms. In this case, if removal of the lens be not deemed feasible, an iridectomy may be made at the point where the lens is in contact with the iris.

Removal of the partially-dislocated lens is always difficult, and apt to be complicated with loss of vitreous, on account of the condition of the suspensory liga-

ment, which is either congenitally deficient or damaged by traumatism.

Great stress laid upon the importance of the immediate use of a mydriatic in injury of the lens. Millikin (*Jour. Amer. Med. Assoc.*, Sept. 3, '92).

In a case of secondary glaucoma from partial dislocation of the lens into the anterior chamber, removal of the lens was followed by immediate cessation of all pressure symptoms. In this case the lower half of a densely-cataractous lens had pushed its way through the pupillary opening and had pressed the iris in this position far back behind it. To effect its removal a peripheral incision was made in the lower outer third of the cornea. A wire loop was introduced and the lens was extracted without the loss of any vitreous, obtaining a clear and round pupil. Oliver (*Wills Eye-Hosp. Reports*, vol. i, p. 1, '95).

Slight partial dislocation of the lens can be cured by the continued use of atropine, which gives the zonula a chance to repair, or by eserine if vision is improved by its instillation and where the tests show that atropine produces a still further tilting of the lens. Dunn (*Va. Med. Semimonthly*, Jan. 2, '97).

When the lens is dislocated into the anterior chamber, extraction is comparatively easy, and, moreover, absolutely necessary. If it is not done, vision is inevitably lost. The lens is fixed in the anterior chamber by the use of miotics or the introduction of Agnew's bident, and the ordinary corneal incision for cataract made. Delivery has to be accomplished by means of the vectis, wire loop, or sharp hook.

Six cases of successful extraction of luxated lenses by the assistance of the Agnew bident. In the use of the instrument, the lens should not be pressed too far into the anterior chamber, as in performing the after-section for the extraction of the lens; the iris and the lens are thus rendered more liable to be cut through, or the section itself may be forced to insufficient size. Pomeroy (*New England Med. Mthly.*, May, '89).

Traumatically dislocated lens successfully removed from anterior chamber of an eye presenting glaucomatous symptoms. After transfixing the lens with a stop-needle, extraction was accomplished by introducing a wire loop through a broad peripheral corneal incision; owing to an irreducible prolapse of the iris, an iridectomy had to be made. Healing was uninterrupted, and normal vision with a correcting glass was regained. Oliver (*Annals of Ophthal. and Otol.*, July, '92).

Three completely luxated lenses successfully removed by the aid of an electric photophore, which was made to illuminate the interior of the eye. After the illumination had been effected a pointed hook was introduced through the sclera to fix the lens, which latter was held in position while an assistant lacerated the capsule with a cystitome that had been introduced into the anterior chamber. The resulting soft cataracts were removed, six or eight days after, by aspiration. Abadie (*Recueil d'Ophtal.*, Aug., '92).

Case of luxation of the lens into the vitreous which caused no symptoms for three years, and then from some unknown cause, the lens having passed into the anterior chamber, the eye became very painful. Massage, which, being done with the fingers on the closed lids, forced the cataractous lens back into the vitreous. To prevent recurrence, the pupil was kept small by miotics. Boggi (*Ann. di Ottal.*, xxv, i, p. 77).

When the lens floating in the vitreous causes iridocyclitis or secondary glaucoma, its removal is indicated. To do this is a matter of great difficulty. If the case be one in which the lens sometimes passes into the anterior chamber, attempts should be made to bring about this change of position by such movements as have previously effected it. Once in the anterior chamber it should be fixed there by the use of a miotic or by the introduction of Agnew's bident behind it. If the lens cannot by voluntary movements be made to enter the anterior chamber, it may be brought to

the anterior part of the eye by the bident and fixed there. It may then be removed by corneal incision, and its delivery usually requires the use of the vectis, or sharp hook. Some vitreous is usually lost, and this is most apt to occur during the removal of the bident, which seems to be the most dangerous part of the operation.

Luxated lens successfully removed from the posterior chamber of an eye by first performing a downward iridectomy, followed two months later by extraction with the aid of a curette, a small amount of vitreous being lost. In eighteen days vision equaled two-thirds of normal. Despagnet (*Recueil d'Ophthal.*, June, '89).

Two cases of dislocation of the lens into the vitreous humor, in which extraction was successfully accomplished by first making an upper corneal section and then expelling the lens by methodical external pressure in the ordinary manner, the speculum having been removed during the latter part of the procedure. Knapp (*Archives of Ophthal.*, Jan., '90).

In the extraction of dislocated lenses it is possible "in many cases, perhaps in the majority, to extract the lens by external pressure, and to confine the use of instruments to assist in the removal of the lens after it has presented in the wound, or, at least, in the field of the pupil." C. S. Bull (*N. Y. Med. Jour.*, Sept. 6, '90).

Lens dislocated into the vitreous removed without iridectomy while the patient was lying prone on an operating-table. Higgins (*Lancet*, Dec. 26, '96).

Knapp and Bull maintain that such lenses can be removed, and have published reports of cases showing such to be the case, without the use of the bident, and without the introduction of any instrument into the eye, by means of external manipulation only.

When an eye is blind and the seat of absolute glaucoma or of iridocyclitis due to dislocated lens, the pain so caused is best relieved, and the danger of sympathetic affection of the other eye most effectually avoided by enucleation.

In a case of dislocation of both lenses into the vitreous, of congenital origin, reported by Bickerton in the *Trans. Oph. Soc. U. K.*, '98, the lens of one eye passed into the anterior chamber, causing reduction of vision to the perception of light and shade. After sixteen days the lens was replaced in the vitreous by a spatula introduced through a corneal incision, with the restoration of perfect vision, the aphakic refraction being corrected.

Case of spontaneous dislocation of both crystalline lenses into the anterior chambers occurring in myopic eyes. The right eye, which was entirely blind and painful, was enucleated, while from the left anterior chamber a partially-degenerate lens was successfully removed. With the exception of an aggravated spasmodic entropion, necessitating operative interference, rapid healing took place, leaving a vision of $\frac{10}{100}$, without the necessity of any correcting lens. De Schweinitz (*Univ. Med. Mag.*, Nov., '89).

Congenital Anomalies.

1. **Ectopia Lentis.** See ANOMALIES OF POSITION.

2. **Coloboma lentis** is a rare condition due to arrest of development at a late period of embryonic growth. The frequent association of coloboma of the iris and choroid with it suggests its relation to imperfect closure of the foetal cleft. Its immediate cause lies in defective development of the zonula of Zinn. This is developed from adhesions, which form between the sides of the lens and ciliary body during the stage of embryonic life when they are in contact. As the eye enlarges, that portion of the capsule to which adhesions have failed to occur would not be held taut and made to expand like the remainder, and a corresponding depression in the lens would result. Absence of the ciliary body would, of course, be a probable cause of this failure to adhere.

Two cases of coloboma of lens in a brother and sister 8 and 11 years old, respectively. The condition is best explained as the result of an alteration, inflammation, or absence of formation of a portion of the zonula, which would permit but a part of the lens to come in immediate contact with the sclera, and that the adhesion thus produced would be the starting-point and cause of the displacement of the lens. Sous (*Jour. de Méd. de Bordeaux*, Oct. 13, '95).

Instance of congenital coloboma of the lens in the left eye of a man 20 years of age. The lens could be seen to exist only for about the upper half of the pupillary space. Extending from the inferior border of the lens-substance to and behind the inferior border of the pupillary margin there was a delicate membrane showing fine, vertical parallel striæ. The inferior border of the lens appeared terraced and transparent, but above this it became opaque. The diameter of the cornea was from one to two millimetres less than that of the right eye. The iris was dull dirt yellow, that of the fellow-eye being brown. In two places the pupillary membrane could be seen. Dunn (*Archives of Ophthal.*, July, '96).

Heyl has suggested that a defect in the inferior branches of the hyaloid artery, which gives nutrition to the lens while the peripheral fibres are developing, would produce just such a defect.

It is often associated with coloboma of the iris and choroid, and with dislocation and small size of the lens. There is sometimes more or less opacity of the lens.

Two cases of coloboma of the lens. In one it was the sole anomaly present; in the other it was associated with partial coloboma of the iris and choroid. Rogman (*Archives d'Ophtal.*, May, '96).

Tremulousness of the iris has been observed, but more especially in cases in which ectopia also has been present.

The defect usually occurs in the inferior quadrant, but has been seen upward, outward, and down and out.

Case of coloboma of lens in a young man, whose father and one brother pre-

sented the same condition. O. D. $V = \frac{1}{20}$, O. S. $V = \frac{1}{25}$, increased in O. D. by the almost complete closure of the eyes when the patient looked at near objects. The lenses were displaced upward and inward, and were transparent, presenting neither coloboma (?) nor atrophy. The ophthalmoscope showed the lens a refraction of + 20 D. and through the aphakic media of - 8 D. The papilla presented a physiological excavation and posterior staphyloma. Hassler (*Lyon Méd.*, Feb. 9, '96).

It resembles in form the chord of an arc, nearly a straight line, but sometimes consists of a complete notch.

It may occur in one eye or in both, and is most commonly associated with myopia. Vision is almost always defective, ranging from absolute blindness up to $V = \frac{1}{4}$, as a rule. But Bresgin recorded a case in 1874 with $V = \frac{20}{20}$ and fair accommodation.

Accommodation seems to be usually present in those cases in which vision is good enough to permit of reliable observation of this point. Nystagmus is sometimes present.

A case has been observed in which a projection from the lens-margin was associated with a coloboma of the iris.

3. Congenital Smallness of the Lens.—In these cases the anterior chamber is deeper than normal, and the iris tremulous. The condition can be recognized only after dilatation of the pupil with a mydriatic. An unusually wide space is then seen between the pupillary edge of the iris and the margin of the lens, which stands out as a dark ring against the fundus. Unusual smallness of the lens often accompanies ectopia and coloboma lentis.

4. Aphakia.—Cases of this condition in microphthalmic eyes have been reported, but Lang expresses the opinion that in many the absence of the lens is apparent only, it being really only displaced out of sight.

The presence of corneal astigmatia (Donders) explains the apparent accommodation of *all* aphaki. Van den Brugh (Ann. of Ophth., Apr., 1901).

5. Lenticonus.—This may occur at either the anterior or posterior pole of the lens, the latter being by far the commoner situation. Only two instances of the former are on record, and there is doubt whether they were congenital or acquired. The condition resembles keratoconus. Anterior lenticonus can easily be recognized by oblique illumination.

Posterior lenticonus requires the ophthalmoscopic mirror for its diagnosis. It gives the appearance of a large oil-drop in the pupil, with a dark, well-defined border. Opacities of the posterior pole of the lens are often associated with it. The refraction is found to be different through the central and peripheral portions of the lens. In one case a remnant of the hyaloid artery was adherent to it.

Reference may perhaps be made here appropriately to the somewhat common cases in which the refraction is found, by estimation with the ophthalmoscope or skiascope, to vary in different parts without any other indication of lenticonus. Sometimes decided differences are found in the upper and lower halves of the pupil. Sometimes the division seems sectional in character.

Case of lenticonus posterior in a girl 7 years of age. Examination of the eye with a concave mirror revealed a bright, circular patch, apparently about 4 millimetres in diameter, located between the iris and the fundus in the antero-posterior axis of the globe. Upon careful study of the reflexes, this was found to project beyond the normal curvature of the lens about 0.05 millimetre. The refraction of the eye through the centre of the lens was myopic about 12 dioptries, and through the periphery there was an hypermetropia of $3\frac{1}{2}$ dioptries. The base

of the cone was probably 2.5 millimetres in diameter. At the apex there was a small opacity, possibly the remnants of foetal blood-vessels. The eye had been convergent since infancy. The fellow-eye showed remnants of the foetal pupillary membrane. Weeks (Archives of Ophthalm., Apr., '91).

Case of lenticonus in a man 65 years of age. When the cone cannot be made visible by focal illumination the points which will enable a diagnosis to be made are: 1. The oil-globule-like disk. 2. The great difference in refraction between the margin of the lens and the central portion, the latter being always highly myopic. 3. The kaleidoscopic movements of the retinal vessels. 4. The exclusion of conical cornea. Knaggs (Lancet, Sept. 19, '91).

Cases of false lenticonus; diagnosis from true lenticonus by Purkinje's images. Demicheri (Annales d'Ocul., Feb., '95).

Lenticonus posterior in a 9-year-old girl. The refraction of the peripheral portions of the lens was + 4 D., while the central portion was — 11 D. Cramer (Klin. Monatsb. f. prakt. Augenh., Aug., '97).

Two rabbits' eyes with lenticonus posterior. Explanation is as follows: Lenticonus arises from changes in the posterior capsule, the hyaloid artery in process of absorption stretching, and finally rupturing, the capsule. Vitreous liquid then causes the lens-fibres to swell and protrude through the break in the capsule. Baeck (Archiv. f. Augenh., xxxvi, 2, p. 160, '98).

6. Congenital Cataract. (See CATARACT.)

7. Remains of Hyaloid Artery and Branches.—Punctate opacities, usually situated a little to the inner side of the posterior pole of the lens, whitish by reflected, dark by transmitted, light, not interfering with vision, discovered incidentally, have been attributed by Ammon de Beck and Mittendorf to incomplete involution of the hyaloid artery.

They are stationary in character, vary in size from a mere point to a poppy-

seed, and, although usually well defined, fine lines have been observed radiating from the edge in some cases.

In some cases of persistent hyaloid artery with attachments to the lens, straight vessels have been seen coming from the end of the disk-like attachment to the lens, and disappearing into the ciliary region at the margin of the pupil.

Parasites.—Three have been described as occurring in the lens: monostoma, distoma, and filaria, the latter occurring in opaque lenses and discovered after removal of the latter on account of the opacity.

F. W. MARLOW,
Syracuse.

LEPROSY.

Definition.—Leprosy is a chronic disease closely allied to tuberculosis, acquired by inoculation with Hansen's bacillus lepræ, but only while the system is susceptible to infection through vital adynamia, inherited or acquired.

[This definition differing etiologically from all those found in literature, it is merely submitted. It seems to advantageously group the solid data recorded and to throw light upon some mooted points. C. E. DE M. SAJOUS.]

Varieties.—It is customary to divide leprosy into two—sometimes three—general forms, the *tubercular*, and the *anæsthetic*, the former being characterized by the formation of tubercle-like nodules; the latter by anæsthetic areas denoting a special involvement of the nervous supply.

[The two main forms differ only in respect to the tissues involved as a result of infection. In many cases they but represent individual stages of the disease and are often blended, the symptoms of both forms being present simultaneously. In text-books the peripheral manifestations are alone dwelt upon as initial symptoms; in this review, the early manifestations of the *typical* disease,

those of the upper respiratory tract, will receive due attention. C. E. DE M. SAJOUS.]

Symptoms.—The earliest symptoms of leprosy in the majority of cases, according to Morrow (who claims to have first called attention to the early evidences in the nasal mucous membrane) and other observers, are alteration of the voice, betrayed by a slight husky or rough phonation—Besnier's *voix lépreuse*—which he likewise considers an early sign; rhinitis, with an abnormally free nasal secretion, sometimes epistaxis, and an increase in the salivary secretion.

Leprosy is always chronic. At its onset nasal or cutaneous involvement is first observed. Of the internal organs, the lungs and the spleen are first affected; later, the liver and intestines; the kidneys very rarely. Albuminuria is uncommon. The nervous system is frequently involved. Goldschmidt (*La Lèpre*; Soc. d'Ed. Scientif., Paris, '94).

Sticker noted that the nasal membrane could appear normal in the first stage or at most show a slight increase of secretion. The first visible change is a simple dry catarrh in circumscribed patches, which eventually present a raw surface. In advanced cases shallow or deep ulcers are visible in one or both sides of the septum. Sometimes there is only a hard swelling, which may be extended to adjacent parts and produce stenosis.

Leprous lesions of the nasal fossa, the mouth, throat, and larynx found in 60 per cent. of the cases examined. Conclusions that chronic coryza is often the first exterior manifestation of leprosy, and that the nasal mucus of lepers is of great virulence and constitutes one of the most efficient sources of the propagation of leprosy. Jeanselme and Laurens (*Bull. Méd.*, July 25, '97).

The systemic invasion of leprosy is usually slow, years rather than months constituting the period of incubation. Occasionally, however, its onset is sud-

den and the disease progresses rapidly. The prodromal symptoms are mainly those of general neurasthenia: anorexia, chilliness, slight ephemeral fever, mental inaptitude, etc. These manifestations occur by exacerbations, and their recurrence is attended by more or less marked impairment of sensibility and other cutaneous functions, perspiration, etc., over restricted areas, fugitive spots suggesting slight erythema.

There is an essential leprosy fever due to the presence of the bacillus lepræ or its toxins. This fever is always intermittent, if uncomplicated. It may occur at any period of the disease, including the so-called prodromal period of some writers, and may or may not be accompanied by an eruption. Since all forms of the disease (lepra) depend on the same organism, the fever probably occurs in all, although in varying degree. When fever of a continued type is observed in leprosy, it is due to the presence of other toxins acting either with, or entirely apart from, those of the bacillus lepræ. The essential fever of leprosy has little clinical import beyond indicating that the disease is active and progressive. Lewers (*Brit. Jour. of Derm.*, Oct., '99).

After the foregoing symptoms have shown themselves with varying activity at various times, receding as often with more or less rapidity and completeness, the erythematous spots become more persistent, are more highly colored and sensitive to the touch, and project beyond the surface to a greater degree. They are reddish-brown, gray, dark-yellow or bronze, and of varying size from that of a dime to that of the palm. They may appear over any part of the body, the face, the trunk, and extensor portions of the limbs. After a time these spots also disappear, leaving a discolored patch, which in dark-skinned persons such as the residents of South American countries, appears white as compared to their surroundings.

[In some cases I had occasion to see in Mexico the appearance of the patients suggested the spots on leopard skins. C. E. DE M. SAJOURS.]

TUBERCULAR FORM.—It is in this form that the naso-pharyngeal phenomena are most marked. The patient experiences slight difficulty in breathing through the nose and the symptoms pertaining to the air-tract already described become quite marked. Then comes the period during which the cutaneous lepromata of Leloir are formed. Localized nodosities appear over various regions,—the face and hands particularly,—varying in size from small shot to a chestnut. The skin appears much thickened, hardened, and puckered, wrinkles being turned into deep furrows; the hairs are often changed in color and fall out. The projecting portions of the head—the nose, chin, and ears—taking part in the thickening, the face acquires a characteristic expression which fully accounts for the horror inspired by these wretched cases. The extremities, especially the hands and feet, are generally affected in the same way. Their skin being thickened and furrowed, they stand out stiffly and are used with difficulty.

The thickened areas, or "tubercles," do not all follow the same course. Some recede, leaving a depressed or less pigmented spot, while others proceed to ulceration. These ulcers are usually small, vary in depth, and their borders, as in the case of syphilis, are sharp-cut and have indurated edges. They heal and reappear several times in succession. When the ulcerative process invades the deeper tissues, they destroy them; muscles, tendons, and even bone yield to its ravages; hence the mutilating effects of the disease. The mucous membranes of the mouth, tongue, pharynx, and larynx take part in the destructive process. The nasal bones and cartilages are markedly

involved: the typical "saddle nose," indicating destruction of the supporting frame-work. A sniffing respiration indicates more or less complete obstruction to the respiration, by neoformations or depressed soft tissues.

Laryngeal examination of a series of cases of leprosy. In one the entire larynx was involved; the epiglottis was compressed laterally and curved backward; the vocal cords were covered with numerous round nodules; the mucous membrane of the subglottic space was thickened and pigmented, as was that of the aryteno-epiglottic ligaments. A second case showed diffuse generalized pigmentation and a small number of nodules. In a third case the larynx was filled with nodules, occupying especially the free part of the epiglottis; the superior vocal cords were irregular and the inferior left cord thickened. In a fourth the laryngeal mucous membrane was almost entirely destroyed, the ventricle and vocal cords were covered with many nodules, and there was considerable ulceration of the lower part of the cords. In a fifth case the internal surface of the larynx was completely destroyed, and in the sixth there was diffuse hypertrophy of the entire mucous membrane, but no nodules. Bergengrün (Univ. Med. Jour., Apr., '94).

Tubercular leprosy progresses slowly: eight or ten years, on an average. It is attended by eruptive and febrile exacerbations, each being followed by a period of comparative quiet. Gradually, however, the patient succumbs through invasion of the viscera, and death usually follows some intercurrent disease: pneumonia, pleurisy, etc.

ANÆSTHETIC LEPROSY.—In this variety the spots are not as numerous, and often begin in the palm and soles. They resemble those in the tubercular form, being erythematous and hyperchromic. But disorders of sensibility are more marked from the start: hyperæsthesia usually precedes anæsthesia, and may be discerned not only over the ery-

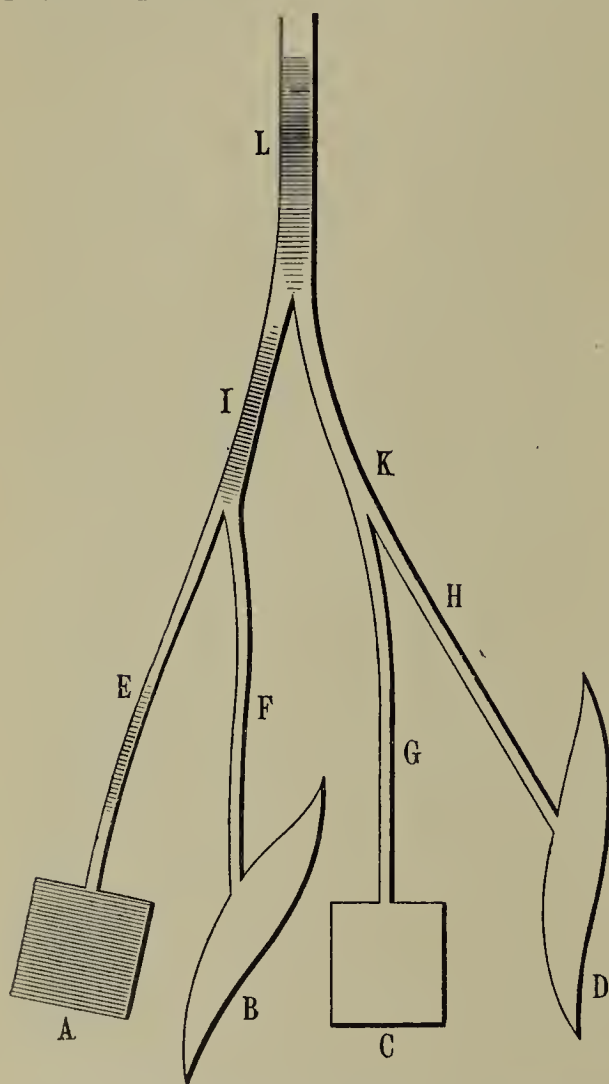
thematous areas, but also over apparently healthy regions.

According to Dehio, leprous skin-spots do not correspond to the distribution of the nerves, but may spread in all directions. Baelz observed that when the body of a leper was rubbed with a powder of fuchsin methyl-violet, then covered closely with absorbent cotton, and pilocarpine was injected into the patient, the healthy perspiring skin became colored, whereas the leprous non-perspiring spots did not.

Leprous skin-spots do not correspond to the distribution of the nerves, but may spread in all directions. Schematic drawing represents a mixed nerve. *A* and *C* are portions of skin with their sensory nerve-twigs (*E* and *G*); *B* and *D* are muscles with their motor nerve-twigs (*F* and *H*); *I* and *K* are mixed nerve-fibres, while *L* represents the nerve-trunk. The shaded portions represent the localities of leprous infiltration. The patches of skin, (*A*) being infected with leprosy and becoming anæsthetic without involvement of the nerve (*E*), subsequently an ascending degeneration attacks the nerve-fibres of *E* and proceeds toward *I*. After a long time the leprous infiltration also reaches *E*, but does not produce any clinical change. So soon, however, as the mixed nerve (*I*) is reached, all peripheral to that becomes atrophied, and we have degenerative atrophy of the muscle, although neither it nor the motor nerve reaching it has been attacked by leprous infiltration. When, finally, the leprous infiltration creeps up and localizes itself at *L*, the whole nerve below this point becomes atrophied, including *K*, *G*, and *H*, which, nevertheless, are free from leprous infiltration. The result is: anæsthesia of the patch of skin (*C*), which itself is not affected with leprosy, and degenerative atrophy of the muscle (*D*). Dehio (St. Petersburger med. Woch., No. 42, p. 632 *et seq.*, '89).

The anæsthesia is so marked that pin-pricks, burns, etc., are not felt. On the other hand, prickling and violent shooting pains are often complained of, cer-

tain nerves, particularly the ulnar and brachial being sometimes greatly thickened and extremely sensitive to pressure. There is also exaggeration of the tendon-reflex. Paralysis of several muscles may occur, with all its attending complications. Considerable mutilation occurs in this form: the toes and fingers are destroyed, the loss being unattended by physical pain.



Schematic drawing representing a mixed nerve. (*Dehio.*)

The general health gradually succumbs to the ravages of the disease, and, the viscera becoming involved, albuminuria, diarrhoea, pneumonia, or some other intercurrent disorder ends the patient's suffering.

COMPLICATIONS OF BOTH FORMS. — Ocular affections of leprosy were studied

by Panas. In the anæsthetic form, lagophthalmos, xerosis of the conjunctiva and iritis, cataract, and phthisis bulbi are frequent; in the tuberculous varieties the cornea and conjunctiva are the chief seats of the lesion, though sometimes the iris, lens, and whole globe become implicated. The favorite seat is the corneo-scleral border, proceeding thence into the corneal substance and to the deeper tissues.

Mental disorders are occasionally observed, melancholia especially. Inflammatory and diathetic disorders of the brain and spinal cord have also been noted. Of the 36 autopsies of maculo-anæsthetic form studied by Havelburg, there were 2 cases of simple meningitis, 1 tubercular meningitis, 1 of nodular tuberculosis of the cerebellum, 2 of hydrocephalus, 2 of degeneration of the posterior columns of the spinal cord, 1 of atrophy of the spinal cord, and 1 of thickening and hyperæmia of the lumbar portion of the spinal cord.

Leprosy exerts a direct influence on the development of dementia, the cerebral phenomena resulting possibly from some irritating lesions of the nervous system, brought on either by Hansen's bacilli or by their toxins. Meschedes (Section of Neurol., Inter. Med. Cong., Aug. 19-26, '97).

Ten autopsies of lepers who had died of the leprosy in Riga, and in four of these cases there were adhesions between the dura mater and the brain; in three of these four cases of adherent meningitis lepra bacilli were found on a level with the pituitary gland. C. Brutzer (St. Petersburger med. Woch., Oct. 17, 19, No. 42, p. 363, '98).

Lepers, male and female, suffer from marked deterioration of the genital functions, and male lepers generally become impotent.

Of 118 cases of leprosy in the Punjab, 73 cases married before the onset of the disease, viz., 43 males and 30 females; and, while still healthy, the males had 71 chil-

dren, mostly now living free from the disease, and the females had 65; total, 136. After the disease had declared itself only 4 females gave birth to offspring,—5 in all. Sixteen males and 23 females married after leprosy had declared itself. Seven married more than once; thus, one man married five wives in succession, and several others married two or three times. The men contracted 26 marriages, the women 29. Only 5 men proved prolific, with 10 children, and 8 women with 15 children. Four children are dead; so that we have left 21 as the progeny of 55 marriages. G. Mustafa (*St. Louis Med. and Surg. Jour.*, May, '91).

Diagnosis.—The diseases from which leprosy requires differentiation are syringomyelia, ainhum, tuberculosis, and syphilis. The similarity between leprosy and the two diseases first mentioned is such that they have been considered identical by some competent observers.

The search for the bacillus may often be facilitated by the induction of abundant nasal secretion through administration of potassium iodide (4 grammes—1 drachm—in one day). In several cases in which examination for the bacillus was negative their presence was readily demonstrated in the increased mucous discharge which ensued the day after administration of potassium iodide. Leredde and Pautier (*Revue Française Méd. et Chir.*, Jan. 12, 1903).

The microscope is the supreme agent of the final diagnosis of leprosy. No patient should be committed to a segregated colony without a bacteriologic demonstration of the disease. Of clinical symptoms, maculæ, chiefly leucodermic spots are found in 89 per cent. of all cases. The lepra nodule found in 74 per cent. is the one chief distinguishing lesion of skin leprosy. Thinning or complete loss of the eyebrows and lashes is present in 63 per cent. Atrophic changes in hands and forearms with retraction and contraction of fingers and enlarged ulnar nerve in 32 per cent., a leading feature of nerve leprosy. The plantar ulcer found in 26 per cent., usually on the ball of the foot. Absorption of phalanges in 16

per cent., with occasional spontaneous amputation. Elephantiasis of hands and feet in 16 per cent. Facial paralysis in 11 per cent. The entire body should be carefully tested for anæsthetic areas.

Several of the above symptoms can be found in some slight degree at least in every leprosy subject. J. T. McDonald (*Journal of the American Medical Association*, June 6, 1903).

SYRINGOMYELIA.—In this disease Hansen's bacillus is absent. The frequent rise of temperature characterizing leprosy does not attend syringomyelia. Though both diseases progress slowly, the active symptoms—headache, paræsthesia, neuralgic pains—appear earlier in the former, while the dermal, muscular, vasomotor, and skeletal morbid changes do not appear in the regular order as they do in syringomyelia. The hands and feet are first involved in leprosy; in syringomyelia the proximal parts of the limbs are first attacked and the destructive process is less marked.

Syringomyelia and leprosy are substantially different affections, both in regard to their etiology and nature, notwithstanding the fact that some cases present a certain analogy in the symptoms. The differential diagnosis between these two diseases is sometimes very difficult. Pitres and Sabrazès (*Archives Clin. de Bordeaux*, May, '93).

According to Evaristo Garcia, the process of resorption of phalanges in the nervous leprosy of tropical South America is perfectly comparable to the process of destruction of the bones in the tabetic. Ashmead (*Jour. Amer. Med. Assoc.*, Mar. 16, '95).

Leprosy often first manifests itself as a non-characteristic macule. The demonstration of lepra bacilli in these spots is of the highest importance. The lesion should be excised, taking tissue beyond the anæsthetic zone, and search for the bacilli must be made in the entire thickness of the derma. Marcano and Wurtz (*Arch. de Méd. Exper. et d'Anst. Path.*, Jan., '95; *Univ. Med. Mag.*, Apr., '95).

The pathology as well as the sympto-

matology of leprosy and syringomyelia afford sufficient means for differential diagnosis.

Symptoms characteristic of leprosy—circumscribed areas of anæsthesia, atrophy of muscles, and trophic and vasomotor changes in the skin, bones, and joints—appear in no regular order. In syringomyelia the sequence of symptoms depends upon the seat of the disease in the spinal cord; when, as in most cases, the cervical

In leprosy the sensations of pain and temperature and of touch are either impaired or entirely absent; in syringomyelia the sensation of touch remains intact.

A slowly-progressing curvature of the spine and disturbance of the function of bladder and rectum further characterize syringomyelia; spindle-shaped thickening of the branches of the peripheral nerves, especially the peroneal and ulnar

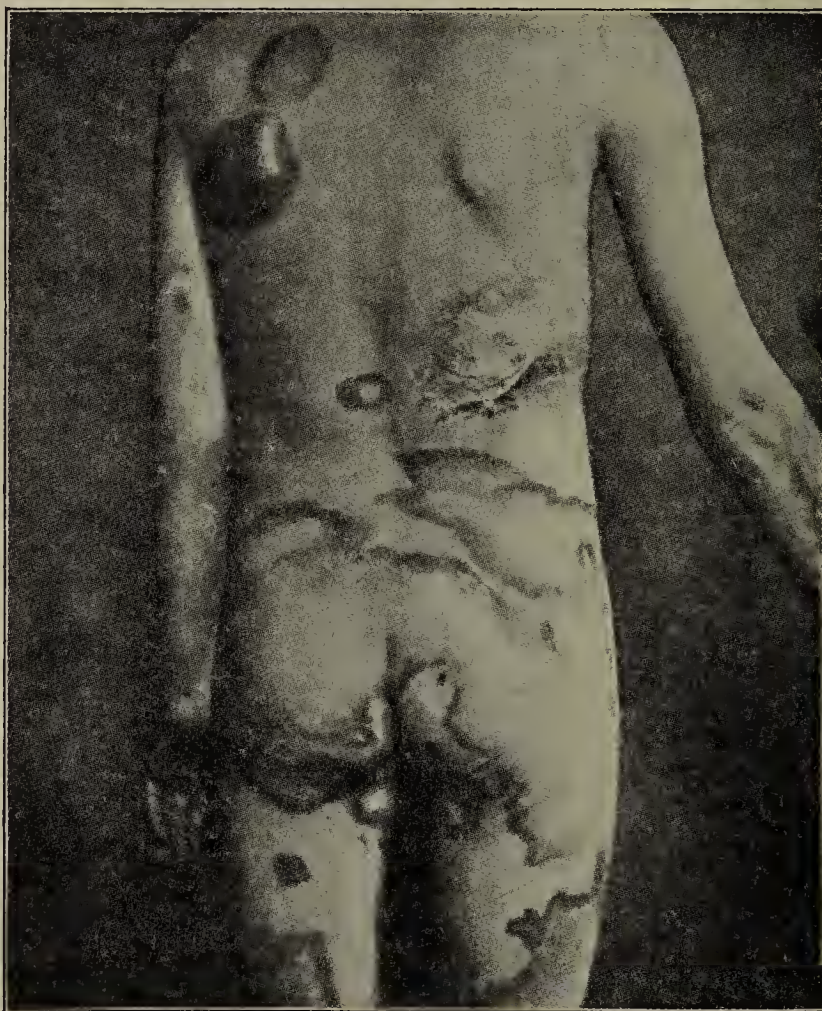


Fig. 1.—Posterior aspect of a case of leprosy of the mixed type.
(*Hersman and Lyon.*)

or dorsal segment is affected, then the upper extremities will be first attacked; the lower may escape for years, and conversely. The face escapes nearly always, or suffers only in the latter stages.

Leprosy attacks chiefly the small muscles of the hands and feet, more seldom those of the forearm or leg; syringomyelia begins in the proximal parts of the extremities; a scapulo-humeral type is pretty frequent.

nerves, distinguish the early stage of leprosy. M. Laehr (*Berliner klin. Woch.*, Jan. 18, '97).

To differentiate between leprosy and syringomyelia, the fundus oculi should be examined. Almost pathognomonic of leprosy is the presence of a large round spot and a number of yellowish-white spots in the neighborhood of the vessels around the macula. These lesions of the fundus are never seen in syringomyelia.

E. von Düring (Deut. med. Woch., Mar. 1, 1900).

AINHUM.—Though Zambaco considers that etiologically ainhum and leprosy may be identical, their clinical aspects are sufficiently dissimilar to prevent errors in diagnosis. Ainhum occurs exclusively in negroes, and consists in the amputation of the little toe by an adventitious fibrous band. Hansen's bacillus has never yet been found in the diseased tissues.

TUBERCULOSIS.—From this disease leprosy is differentiated mainly by the bacillus and through the absence in tuberculosis of anæsthetic areas. The injection of tuberculin may, according to Babès and Kalindero, assist in the differentiation. In tuberculosis the general reaction, after the injection of tuberculin, begins about six hours after inoculation; in leprosy it generally comes on twenty-four, or, less frequently, in twelve hours after inoculation.

Three cases of lepra with ulcers in the intestines. In two of these there was at the same time tuberculous disease of the lung. The ulcers, however, were distinguished by great thickening and bluish coloration of the edges. In the third case the ulcer was flat, rounded, and with a sharp edge. No tuberculosis of other organs could be discovered. Microscopically lepra bacilli were found in the third case, while in the ulcers of the first and second bacilli could only be found. Von Reisner (Monats. f. Prakt. Derm., No. 5, '96).

SYPHILIS.—The course of this disease usually serves to facilitate diagnosis, while Hansen's bacillus is not to be found. Fournier states that general or local analgesia and anæsthesia are frequently observed in syphilis; he found, however, that, if present at all, they occur on the dorsal surface of the metacarpal portion of the hand.

Case of anæsthetic leprosy in an unmarried male aged 27. The case at first

supposed to be one of rheumatism, then beriberi, and finally tertiary syphilis. J. G. Gimlette (Lancet, Mar. 3, 1900).

Evidence afforded is against the supposition that the spread of the disorder is even remotely affected by the hereditary transmission of the disease. Whatever may be the source of the predisposition to the disease, assuming its existence, it is most certainly not specific—not always due to the leprosy of an ancestor. Persons with severe grades of leprosy, far from transmitting the disease to their offspring, are apt to have no offspring at all. In the Soudan the most frequently operating factor, not in causing the disease, but in assisting to determine its incidence, is that of a badly balanced and therefore inefficient diet. The communistic way in which unwashed clothes are handed about has



Fig. 2.—The so-called "leper-claw."
(Hersman and Lyon.)

a direct influence on the spread of the disease also. T. J. Tonkin (Lancet, April 18, 1903).

Etiology.—That leprosy is but slightly contagious is the opinion of the great majority of dermatologists. Not only have repeated inoculations failed to give rise to the disease, but cases have been reported showing that a person may reside with a leper, sleep and eat with him, nurse him, handle and wash his linen, and even wear his clothes with impunity.

In spite of the general diffusion of the disease, those who know most about it doubt its contagiousness. In numerous mixed marriages coming under personal observation the disease has never been transmitted from one party to the other. Often a single member of a family is a leper, and yet mingles without restraint with the others, adults and children.

Nurses and attendants in leper hospitals, often religious devotees, care for lepers and live in their midst for years without contracting the disease. Zambaco (Bull. de l'Acad. de Médecine de Paris, No. 32, '89).

Analysis of 1034 cases of leprosy in every stage of the disease. Not a single case could be traced to contagion such as sleeping with, eating with, or nursing a leper, and handling or wearing his clothes. Chew (Med. Age, Dec. 27, '98).

Still, there is considerable testimony in literature tending to prove that leprosy is contagious under certain circumstances, as will be shown under PROPHYLAXIS. Observers who have had occasion to study large numbers of cases generally uphold this opinion.

In the Hawaiian Islands kissing and nose-rubbing, which are the native forms of salutation; cohabitation; and the reception of the secretion of lepers through abrasions of the skin are considered as causes of communication. The natives eat *poi*, or *pai'ai*, as well as other kinds of food, with their fingers, from the same dish. Worse than this, they make the native drink, called "*awa*," by masticating ti or ki leaves, and depositing the pulp in an earthen jar, where it is allowed to ferment after which they drink it as an intoxicating beverage. The opinion generally prevails among physicians and the more intelligent classes of people on the island that leprosy is very frequently communicated by sexual intercourse. There is no reason why this should not be the case, as we know that abrasions of the mucous membrane are among the earlier manifestations of the disease. The mosquito, house-fly, and other insects have been accused of being carriers of the disease. C. E. Davis (Albany Med. Annals, Feb., 1901).

Clinical evidence tends to demonstrate that leprosy is not hereditary in the true sense of the word (though a foetus may be infected by a leprosy parent and be leprosy at birth), but that a proclivity to the disease is inherited by the off-

spring, and that exposure, in his case, will lead to its development.

In order to produce the contagion, it is necessary that the person contracting the disease be under the influence of certain special conditions, and surrounded by certain causes, and that his system be prepared beforehand to receive the leprosy germ; in other words, the ground must be prepared for the planting of the seed.

"I have observed many cases in which the disease has passed from generation to generation, and have noticed that leprosy, unlike most hereditary complaints, rarely disappears in one generation to reappear in the next. One of the patients being a leper, the son is in imminent peril, even should he have been procreated before the appearance of the first symptoms in the parent." Flores (Satellite of the Annual, Nov., '87).

Parasitism does not necessarily involve the idea of contagion, and it would be an error to believe that every bacterial parasitic disease can be transmitted from the affected person to those who live with him. The latter must be in an especial condition of receptivity in order that contagion may occur. Cornil (French Acad. of Med., Annual, '89).

In the Delta, situated two kilometres from the French Concession of Hanoi, and containing 400 inhabitants, almost one-half are affected with leprosy. Eighty to 90 per cent. of the children of lepers contract the disease, which usually appears for the first time about the eleventh year. Editorial (Brit. Med. Jour., Jan. 3, '91).

Leprosy is a family disease, and children of lepers more easily acquire leprosy by early infection. Arning (Archiv f. Derm. u. Syph., H. 1, '91).

Leprosy is certainly not hereditary, and can only be spoken of as possibly contagious, an absolute demonstration of infection from direct contact being still lacking. Possibility suggested that human beings are but temporary hosts of the parasite, it having possibly some extrahuman habitat. K. Grossman (Brit. Med. Jour., Dec. 5, '96).

Leprosy, particularly as it occurs in Iceland, has increased somewhat in recent

years. Of 119 cases examined, in 56 there was a history of the disease in the family. Of these, the father and mother were affected in 3; father alone in 15; mother alone in 4; sisters or brothers in 4; distant relatives in 14. Ehlers (*Derm. Zeit.*, No. 3, '96).

Investigation of 1034 lepers. Of these 10 were born leprosy; 21 contracted leprosy from their parents before puberty. The disease skipped the first generation to attack the second in some, and the third in others. There were 15 that were born leprosy, of healthy parents. R. S. Chew (*Med. Age*, Dec. 27, '98).

Conditions capable of sufficiently reducing the vital resistance of the organism—insufficient or unwholesome food, excessive use of salt, a fish diet, exposure to cold and damp, alcoholism, malaria, overwork, syphilis, tuberculosis, etc.—are recognized predisposing factors. They seem, in my opinion, to render the organism susceptible to the influence of the leprosy bacillus precisely as does heredity. This view, advanced by myself in 1887, is sustained by considerable evidence.

Leprosy is perhaps the best example of the extreme condition of catabolic stasis. Syphilis in many respects resembles leprosy and belongs to this same class of suboxidation diseases, *i.e.*, disease symptoms, whether the disease is due to a microorganism or not, are due to toxins or chemical poisons. These toxins or poisons act by reducing the catabolic functions of the body tissues, and the result of such a state of depressed activity is the disease as we know it. Homer Wakefield (*Med. Rec.*, Jan. 2, 1904).

Case in a man of 27 years, who became ill five years before at sea during a storm, when he caught a severe cold. The advance was gradual though well marked. The skin presents at places thickened spots of a dark bronze color, especially noticeable at the tip of the nose. There is an almost complete absence of hair over the eyebrows and lashes. G. Lelewsky (*Prakt. Vrach.*, Nos. 9 and 10, 1904).

According to Jeanselme and Laurens, and Sticker, lepers eliminate the bacillus of leprosy in enormous numbers through the upper respiratory tract and particularly the nasal cavities. During the active stages of the disease the nasal secretions and the sputa of the subjects thus disseminate the bacillus of leprosy, by emptying their nostrils and expectorating over the restricted grounds in which they are segregated.

Leprosy is essentially a Chinese disease, extending from its focus in the southeastern provinces to every region visited by the lower class of Chinamen, and to no others. James Cantlie (*Lancet*, Jan. 1, '98).

The telluric origin of leprosy would thus find an explanation. Though but slightly communicable by the leper himself when free, his compulsory segregation within a certain area of ground would thus cause him to transform this area into a focus of infection. His sputum, nasal secretion, and other contaminated ejecta would play the rôle in leprosy that the sputum plays in the propagation of tuberculosis.

[In formulating this hypothesis I wish to emphasize the fact that it is only supported by collateral evidence. Still it seems to clear many mooted points. It was therefore deemed sufficiently suggestive to merit incorporation in these columns. C. E. DE M. SAJOURS.]

A subject predisposed by heredity or debilitating factors could thus become infected in various ways by dust or water contaminated with secretions containing Hansen's bacilli. The upper respiratory tract is particularly exposed to infection through dust inhaled. The breath of the patient, especially during the act of sneezing, has been found charged with bacilli, and the air so charged may come into contact with the nasal mucous membrane of persons in the immediate vicinity.

The front part of the nasal mucous membrane and the greater portion of that covering the nasal sputum, is the region which leprosy first, and perhaps always, attacks. One hundred and forty-three lepers examined to ascertain this fact. In 55 out of 57 cases of tubercular leprosy the leprous bacillus was found in the nasal secretion, and yet in only 2 cases were there any leprous nodules in the nose. In 45 out of 68 cases of anæsthetic leprosy, and in 27 out of 28 of the mixed form, the bacillus was also found.

In 23 out of 153 cases there was evidence of disease in the bronchi, but in only 14 of these were leprous bacilli found in the sputum. In 10 out of 27 cases in which the exudation from the ulcers was examined, the leprous bacilli was found. In 21 cases the bacillus was demonstrated in the secretion of the fauces in 9 instances. Sticker (*Münch. med. Woch.*, Nos. 39 and 40, '97).

Experiments showing that very great numbers of bacilli were given out in sneezing,—in one instance more than 110,000. Conclusion that in lepers in whom there is an affection of the mucous membranes of the air-passages, not necessarily of an extreme grade, thousands of bacilli are thrown out to a considerable distance in speaking, coughing, and sneezing, and that this dissemination cannot be prevented by therapeutic measures. Dissemination of the bacilli from the upper air-passages is relatively the most important of the various ways of infection. Schäffer (*Archiv f. Derm. u. Syph.*, '98; *Boston Med. and Surg. Jour.*, Mar. 16, '99).

The statement of Sticker, who had found the bacillus in the nasal secretion in 83 per cent. of the patients examined, confirmed. Personally examined 142 cases with this object: 50 with nodular leprosy, and 92 with maculo-anæsthetic symptoms. The bacillus was discovered in 50 cases, 46 of which belonged to the nodular type and 4 to the anæsthetic. Nearly all nodular lepers throw out large quantities of bacilli by the mouth in the act of sneezing or talking loudly, but this occurs more rarely during ordinary conversation. Bacilli were not found as a result of forced expiration.

Lie (*Brit. Med. Jour.*, Jan. 26, 1901, from *Lepra*, vol. i, Fasc. 1 and 2).

Abrasions and solutions of continuity of the skin or mucous membrane, etc., may thus also afford an entrance to the specific germ.

Twenty-six cases observed in which inoculation occurred through accidental abrasions and other injuries. Chew (*Med. Age*, Dec. 27, '98).

Morrow advanced the theory that, like syphilis, leprosy was usually communicated by sexual intercourse. In Chew's statistics but 7 cases out of 1034 can be traced to coitus; but, as already stated, the period of incubation of the leprosy is long and the disease may thus frequently be communicated and show signs of its existence long after intercourse. Hansen's bacillus has been found in semen.

In the hospitals in Rio Janiero some of the attendants have been attacked in spite of thorough precautionary measures. Period of inoculation appears to be, in some cases at least, as much as two years, and may possibly be longer. The disease is frequently associated with tuberculosis. Havelburg (*Berliner klin. Woch.*, Nov. 16, '96).

Women in China are active disseminators of infection, "selling the disease," as they called it, in the belief that they can free themselves by coitus with a healthy man. James Cantlie (*Lancet*, Jan. 1, '98).

Of the 1034 cases studied 624 were married, and in 4 cases only did the husband infect his wife, while on 3 occasions the wife infected her husband. While 44 of the married lepers had had no children, there were no fewer than 1566 conceptions. R. S. Chew (*Med. Age*, Dec. 27, '98).

[Dr. Chew's statistics seem to invalidate the view that impotence accounts for limited birth-rate among lepers. As in the case of syphilis, it is more probable that the influence borne exerts itself upon fetal development. C. E. DE M. SAJOURS.]

Sex does not seem to have much in-

fluence upon the development of the disease, though male lepers are by far the more numerous. It may attack children as well as adults, but it is most frequently met with in persons between twenty and forty-five years of age: the period of life attended by the greatest exposure.

From an investigation of 1034 lepers in every stage of the disease the annexed table gives the conclusions reached as to etiology. Roger S. Chew (Medical Age, Dec. 27, '98).

Distribution.—Leprosy is most prevalent in India, where, according to Zambaco, there are 130,000 cases; but the disease is thought to be increasing. It is also met with extensively in China; but less so in Persia, Japan, Tonquin, Siam, Anam, the Antilles, and South America.

It is estimated that there are 30,000 lepers in the departments of Boyaca and Santandeo, in the United States of Colombia. E. H. Plumacher (Abstract of Sanitary Reports, Nov. 13, '91).

Leprosy also exists in Norway, Sweden, Russia, Spain, Italy, Roumania, Greece, Turkey (at least 4000), and in a modified and light form in France.

In the English-speaking sections of North America the cases are compara-

tively few. An inquiry by Dr. Osler has elicited the fact that there were five foci, two in Canada, aggregating about 40 cases, and three in the United States, aggregating about 300 cases. Dr. I. Dyer, at the Berlin Leprosy Conference, reported that there were 126 cases in Louisiana. Wisconsin and Minnesota are computed to contain about 150, all Swedes and Norwegians. The cases are gradually decreasing in number. In the Hawaiian Islands, according to Morrow, there are about 1200 cases at Molokaï. Sporadic cases are occasionally met with in our cities.

Since 1866 five deaths from leprosy have been reported in New York. Editorial (Brit. Med. Jour., Dec. 19, '91).

Pathogenesis.—A specific bacillus closely allied to the bacillus of tuberculosis has been shown by Hansen in 1871 to be the exciting cause of leprosy. The labors of Neisser have confirmed Hansen's discovery. The bacillus lepræ is a long and slender, motionless rod, with slightly-tapering ends. It reacts in the same way that the tubercle bacillus does to coloring reagents, but much more readily—a distinctive feature—and takes aniline dyes, which tubercle bacilli do

LEPERS BY NATIONALITY AND HOW DISEASE WAS OBTAINED.	Proved to climatic and telluric causes.		Proved to food and drink.		Proved to direct blood- taint—i.e., heredity, inoculation.		Leprosy to other causes.		Total cases.		
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Both Sexes.
<i>Adults.</i>											
Europeans and East Indians	44	8	9	9	48	15	10	10	111	42	153
Mohammedans	68	22	66	22	50	3	44	5	228	52	280
Hindoos	87	20	50	24	37	14	77	18	251	76	327
Other races	33	1	39	26	17	6	13	1	102	34	136
Total	232	51	164	81	152	38	144	34	692	204	896
<i>Children.</i>											
Europeans and East Indians	4	..	2	1	12	4	1	..	19	5	24
Mohammedans	1	1	1	..	13	4	1	..	16	5	21
Hindoos	11	2	3	2	31	12	6	3	51	19	70
Other races	3	2	..	2	7	6	2	1	12	11	23
Total.	19	5	6	5	63	26	10	4	98	40	138
Total of all ages.	251	56	170	86	215	64	154	38	790	244	1034

not. Again, the bacilli of leprosy are usually much more numerous.

Method adopted and now advocated for bacteriological diagnosis of leprosy is exceedingly simple. A cover-slip is smeared with a drop of the serum obtained by scraping one of the leprosy-nodules. This is stained with carbol-fuchsin and decolorized with sulphuric acid and methylene-blue (Gabbett's fluid). It may then be examined under the microscope.

In tuberculous lesions of the skin the bacilli are always very scanty, and usually only a few are found in the entire cover-slip; but in lepra each microscopic field shows enormous numbers of them. The lepra bacilli also readily stain by the simple aniline dyes, while tubercle bacilli do not. In choosing a nodule from which to take the specimen, it is desirable to select one in an early stage of development, before much scarring has taken place. Johnston and Jamieson (*Montreal Med. Jour.*, Jan., '97).

The bacillus of leprosy is found in all cases, but reliable cultures have not been obtainable so far; while experimental inoculations, as previously stated, have given no results. Still, fragments of nodules introduced into a rabbit's eye by Melcher and Ortmann caused development of the disease in the animal and death. Arning thought he had successfully inoculated a condemned criminal with matter obtained directly from a leper, but the subject was subsequently found to belong to a family (including his son and nephew) in which the disease existed: a fact demonstrating his proclivity to the disease.

[Arning's case seems to show that previous inoculation experiments in man were negative because the subjects were in sufficiently good health to antagonize the influence of the pathogenic germ.

This would suggest that a subject rendered susceptible by the various factors capable of inducing adynamia could temporarily become liable to infection when exposed to the disease, and remain so as long as his physical debility would

last. Even under these circumstances the period of incubation could be a prolonged one. C. E. DE M. SAJOUS.]

The life-history of the bacterium lepræ is an extremely complicated affair. Animals are not receptive to the microbe in all its forms of development. In one phase it loses its specific stain (Ziehl-Neelsen method), not only when passed through 1 per cent. of sulphuric acid solution, but when water only is used, although its clinical characteristics remain the same. Barranikow (*Brit. Jour. of Derm.*, March, 1901).

The introduction of the virus through abrasions, scarification with medicinal substances and vaccination, which together represented almost one-fourth of the etiological factors noted by Chew in his 1034 cases, demonstrates that transmission by inoculation is, in reality, an important factor in the pathogenesis of the disease.

The bacilli are to be found in all tissues and liquids of diseased areas only, and particularly in the lepromata.

Lepromata found to contain large numbers of bacilli. In recent cases the bacilli are almost all present in the cellular elements. Later they multiply, forming a globular mass, and the cell becomes gradually destroyed, freeing the bacilli. With the juice of a cutaneous non-ulcerated leproma, inoculations made on blood-serum and on glycerin-agar, the tubes being kept at a temperature of 98.6° F. Cultures developed in all the tubes. Growth was arrested at 68° to 77° F. Gianturco (*Gior. del Assoc. Napolitana di Med.*, etc., '91).

In general, the bacilli develop at the same time in the fixed cells of the connective tissue and the migratory cells. The proliferation of the cells is remarkably slow, notwithstanding the great number of bacilli, and is not induced in their immediate vicinity; in the periphery of the bacillar foci the tissue is healthy. In the cells the bacilli multiply more and more and there finally form small, brownish, globular masses, in which the bacilli are very numerous and

close to one another. At this stage the softening of the leprous nodules begins, the degenerative evolution of which thus differs decidedly from the caseous degeneration of tubercle. Lie (*Archiv f. Derm. u. Syph.*, B. 29, H. 3, '95).

The bacillus is demonstrable in the macules; the macules are of the same histo-pathological structure, whatever their clinical form; through gradual stages the macules may pass into fully developed nodules, having the same nature as the nodules.

In the early diagnosis of this disease the possibility of demonstrating the bacillus is of great importance. J. Darier (*Ann. de Derm. et de Syph.*, vol. viii, No. 12).

Leprosy is contagious only after a very intimate and long-continued intercourse. Autoinfection within the body takes place by dissemination of the bacilli through the muscular system. E. Baelz (*Berliner klin. Woch.*, vol. xxxv, Nos. 46 and 47).

Secretions and tissues of a case of leprosy examined; bacilli found in the blood of diseased tissue, sweat, epidermis, and sperm, but not in the blood of healthy tissues, in the urine, or sputum. Faber (*Deut. med. Woch.*, June 1, '97).

The bacillus of leprosy cultivated in human blood-serum. Two forms were observed: long and slender bacilli, and short and almost elliptical in shape. The bacillus was Hansen's bacillus, because it resists decoloration by 30-per-cent. nitric acid; there was no reason to believe that any other organism was introduced when the tubes were inoculated; the filtered fluid from the cultures when injected into horses produced the same reaction as serum from lepers' blood; the serum of horses subjected to injections of culture filtrates produced the same reactions in lepers as the serum from horses infected with serum of lepers' blood; the bacillus stains in the same way as Hansen's bacillus. Carrasquilla (*Nat. Acad. of Med. of Bogotá*, '99; *Brit. Med. Jour.*, Oct. 14, '99).

Successful attempts to cultivate the *B. lepræ*. Small portions of a leprous nodule were placed in various media with no result. With leper serum, how-

ever, the Pfeiffer reaction was obtained; that is to say, in a dilution of 1 in 50 to 1 in 100 marked bacteriolysis occurred; control experiments with other bacteria showed that this action was specific for the *B. lepræ*; also normal and other serums failed to produce the same bacteriolysis. This appears to show that the organism cultivated is the true bacillus lepræ. Van Hontum (*Jour. Path. and Bakter.*, Sept., 1902).

The blood of lepers in various stages of the disease was carefully studied by Winiarski. When leprosy has not given rise to great changes in the organism, the composition of the blood is not much altered. No change in its composition, in the various forms of leprosy (anæsthetic, nodose, and mixed) could be demonstrated. In chronic cases the number of blood-corpuscles was always found to be diminished, on an average, 17.9 per cent. in men and 12.3 per cent. in women. The hæmoglobin was decreased, on an average, 6.3 per cent. in men and 2.4 per cent. in women. The white blood-corpuscles were usually normal in quantity. In all cases of leprosy a large preponderance of multinuclear leucocytes was noted.

Prophylaxis.—At the International Conference on Leprosy, held in Berlin in 1897, the conclusions reached were the following: (1) the leprosy bacillus discovered by Hansen is the true cause of the disease; (2) man is the only animal in which that bacillus exists; (3) leprosy is contagious, but is not an hereditary disease; (4) isolation of leprous patients is desirable, and under such circumstances as exist in Norway; (5) compulsory isolation is to be recommended.

Results of segregation in Norway: In 1856 there were 2871 lepers in Norway and now there are hardly 800.

In all countries where leprosy is met with endemically, isolation has proved the most useful method of preventing the

spread of the disease. The worse the social relations, the greater is the danger from contagion. Hansen (*Monats. für prak. Derm.*, B. 25, No. 9).

That segregation is an effective prophylactic measure for the protection of the public at large against leprosy is undoubted. The same statement would be applicable, however, were syphilitic, tuberculous, and other infectious subjects to be compulsorily isolated and ostracized from society. Indeed, it would apply more forcibly, since all the evidence at our disposal tends to prove that leprosy is one of the least contagious of infectious disease, though undeniably so in predisposed individuals.

A handsome young lady of good family married a leper, and lived with him eight years. Partly through jealousy on his part, and partly through devotion on hers, they made every effort to share the leprosy in common. The leprous husband caused her to kiss his ulcerated tongue constantly, and numerous attempts at inoculation were made. Nevertheless, the husband finally died of leprosy, while the widow still lives in perfect health. Zambaco ("*Des Affections Nerveuses Syphilitiques*," '62).

Of the 156 Norwegian lepers settled in Minnesota, only 12 or 14 are now dead. It is, indeed, strange that these lepers have not communicated the disease by heredity or contagion. It is because their habits in the old country were so slovenly, and because they herded together; whereas, in America they become cleanly and live a less promiscuous life. Each of the lepers personally seen in Minnesota had his own bed and his own room. A. Hansen (*Edinburgh Med. Jour.*, June, '91).

[Kuusamo, Finland, was for a long time a small, but obstinate, focus for leprosy, 16 deaths having occurred between 1774 and 1800, and 22 between 1800 and 1828. In 1807 the lepers were isolated, and remained thus until 1845, when the hospital system was abolished, and the lepers were visited twice a year in their own houses by the medical officer of the district. After 1865 no further reports

were presented, and in 1871 the medical officer reported that he was unable to find any more cases of leprosy in Kuusamo. WALTER WYMAN, Assoc. Ed., *Annual*, '92.]

Some of the victims at D'Arcy Island were removed from white homes where they were employed as cooks, yet no whites in the city here ever contracted it. Ernest Hall and John Nelson (*Dominion Med. Monthly* and *Ontario Med. Jour.*, Dec., '98).

Some years ago the Indian government appointed a special commission on leprosy, and from their report it appears that they could not get sufficient evidence to prove for certain that the disease is propagated by contagion.

There are many instances of a leper and non-leper living as man and wife without the healthy one contracting the disease. On the other hand, several cases are reported in which some casual inoculation of the leprous matter seems to have resulted in the propagation of the disease in a subject free from previous taint.

No case of leprosy has occurred among the attendants of the above asylum, who dress the lepers' sores and rub in oils and other applications with their bare hands. N. S. Rudolf (*Medical Age*, Jan. 10, 1900).

The history of the disease in all countries, and among every class of people, points to the certainty of contagion. It has been traced to sources. Its course has been progressive when segregation has not been enforced, and retrogressive when it has. In proportion to the failure to carry out segregation, the disease has advanced. Families which in England are and have been free from the taint of leprosy go to China, or elsewhere, where leprosy prevails, and become leprous. Dressers, nurses, and physicians in leper hospitals contract the disease quite frequently. To Louisiana the disease came with some French settlers; to New Brunswick with Frenchmen; to Minnesota with Norwegians, and so on. In each location where the disease developed carriers had come from leper-infected places. As in tuberculous disease of the lungs, there is no doubt a

tendency transmitted, a peculiar make-up furnished, which is more susceptible to certain specific inoculations. This is evident in the Polynesian. Its members readily acquire leprosy, and the tendency is increased by their habits of life. E. S. Goodhue (Med. Record, Jan. 27, 1900).

The bacilli of leprosy are only found in diseased tissues and in the blood, discharges, etc., of the latter. It is a question, therefore, whether the healthy areas of skin and mucous membrane are not subject to reinfection from external causes (see ETIOLOGY) capable of inducing the disease in any predisposed subject.

[Autoinfection in chancroid offers a precedent of this kind, although no specific germ is at present thought to act as intermediary. Even in true syphilis well-authenticated cases of autointoxication have been observed.

Reinfection in syphilis tends likewise to sustain the view that reinfection in leprosy is quite possible. A series of cases accurately reported by trustworthy observers have led Horovitz (Allg. Wiener med.-Zeit., Sept., '93) to conclude that "the doctrine that there can be no recurrence in syphilis has been forever refuted." In all the cases reviewed at least the secondary manifestations had recurred.

Successful inoculation experiments were performed by Bouley (Jullien, "Maladies Vénériennes," Paris, '85). This author inoculated a patient suffering from tertiary manifestations; a chancre resulted, followed thirty days later by general manifestations. These experiments were successfully repeated by Horand. Wallace also obtained by inoculation a chancre in a case of secondary syphilis. A large number of cases could be cited in support of the contention that even in syphilis immunity is not invariably acquired through the first infection.

Considering (1) the slow progress of the bacillus leprose through the tissues, (2) the fact that diseased regions alone contain the organism, and (3) that the general blood-stream contains no bacilli, the belief seems warranted that the uninfected areas of a leper are liable to con-

tamination, through solutions of continuity of the mucous surfaces or of the skin, epithelial denudation, absorption into the gastro-intestinal canal, etc., when brought into contact with leprosy bacilli of external origin.

The natural history of the organism is not sufficiently known to warrant for this view more than the position of a working-hypothesis. C. E. DE M. SAJOUS.]

Segregation within a restricted district under such circumstances would greatly compromise the chances of recovery of the sufferers so segregated. Constantly-exposed to contaminated soil and surroundings, reinfection would seal the doom of many who, under the influence of hygienic surroundings, would be restored to health by appropriate treatment. Lazarettos, pest-houses, etc., would thus become foci of infection.

It is probable that the mouth and nasal cavities are the avenues of entrance of the bacillus leprose. Leprosy is contagious, but not hereditary. Hansen (Monats. f. prak. Derm., B. 25, No. 9).

This is strongly sustained by the fact that in such institutions practically all the patients die of the disease or its complications, while, among lepers only exposed to the average contaminating influences of cities, many are saved.

Of 1034 cases of leprosy observed during a period of 14 years and 9 months, 422 have been cured of their loathsomeness, while medicines failed to make any lasting impression on the remaining 612. R. S. Chew (Med. Age, Dec. 27, '98).

According to Morrow's computation, the number of lepers in the Molokai settlement (Hawaii) averages about 1200, but he contends that, notwithstanding the optimistic view of the health authorities that leprosy is on the decrease, the annual consignment of lepers to the settlement shows but little, if any, diminution. "All the indications point to the existence of a vast deal of latent leprosy, which, as the disease develops into a recognizable form, must continue for

many years to come to furnish a constantly-recurring series for the leper colony."

What probably does exist in Hawaii is a large number of vulnerable individuals, vulnerable through the operation of the various factors enumerated, and especially active, in our new possession, on account of the deteriorated state of the natives. These etiological factors, as well as susceptible subjects, are to be found in all countries and especially in districts where poverty, filth, bad food, and alcoholism prevail. Were compulsory isolation abandoned, therefore, leprosy—like syphilis, tuberculosis, cancer, etc.—would assume the position of a general disease, its development being commensurate with its low degree of contagiousness and the hygienic level and customs of the communities exposed. In the United States the debilitating influence of excessive and unduly prolonged physical and mental activity would tend to increase vulnerability, and the dissemination of leprosy might thus be greatly enhanced.

In all countries where leprosy has become epidemic its advance is insidious; it spreads slowly, and, before the health authorities awaken to a realization of the danger, it has made such headway that its further progress cannot be arrested. Morrow (N. Y. Med. Jour., Nov. 7, '96).

Segregation of lepers is, therefore, imperative, but only on the condition that they be compensated for their isolation on behalf of others by adequate protection against continued infection and by the most conscientious efforts to restore them to health and to their families.

According to Brocq, the first leper, a Chinese coolie, was discovered in the vicinity of Honolulu in 1853. Eight years later several lepers were found among his associates, and twenty years after this (1880) with a population of 44,000

people, there were 2000 lepers upon the Hawaiian Islands (statistics of Wood, White, and Tyson).

A leprous fisherman, who came from San Mauritius to the Island of Rodriguez, infected this place. The island of Pinez was, according to Fourne, infected by prisoners brought from New Caledonia. Eight years later the disease broke out among the natives.

Zuranga reports that a leprous sailor, while visiting in Parcent, infected the friend and the brother of the friend with whom he was stopping. The former infected a friend, who, in his turn, infected a number of his acquaintances.

Fourne found that Toured, a village near Nice, was, up to 1850, free from leprosy. During this year, the family, M., engaged a leprous servant, and following this both M. and his wife contracted the disease; subsequently in the family G., with whom the M.'s had associated, a cousin of the family G., his wife and three children, became affected.

Ghose saw a case in which the wife became infected by her husband. After the death of her husband she returned to her former home, a village free from leprosy, where she lived in the house of her brother. The brother became affected; and during the next six years three persons in the neighborhood.

The infection of physicians and clergymen in contact with lepers (Dr. Robertson, Father Damien, Father Boglioli, Pastor Becker, etc.) are well known. These cases are only a few of the great many which can be found in the literature. Those mentioned are particularly conclusive and direct. E. O. Jellinek (Progress of Med., Feb. 1, '99).

In some "settlements," "lazarettos," or "pest-houses" these unfortunate *patients* (some of which may not be leprous and be suffering from tuberculosis, syringomyelia, or syphilis) are practically assimilated to criminals awaiting the death-penalty, while neglect, both general and professional, is insidiously acting as executioner.

About a league off the eastern coast of Vancouver Island, and separated from it by the waters of the Gulf of Georgia, lies

the pretty little island of D'Arcy. . . . Hidden away in their little cabins under the grateful shade of the fir, with their hot blood burning out their life, the victims of this plague are slowly dying with their faces to the rising sun. . . .

Following the policy of isolation, most notably exemplified at Molokaï, in Hawaii, and also adopted at the Tracadie Lazaretto, in eastern Canada, the Victoria City Council, eight years ago, removed the victims to D'Arcy Island, where a line of huts, all under one roof, were erected for their accommodation. . . . Here the unfortunate sufferers are regularly supplied with rations and properly provided for without imperiling public health. . . . *Every three months* the sanitary officer of the city of Victoria visits the settlement with a sufficient supply of food for the following quarter. . . .

As our dory grates on the shore, and we hurry up the incline to their homes, the real wretchedness of their condition becomes evident. . . . Every development and every type of this loathsome disease is apparent in the little group before us. . . .

The monotony of the existence of these unhappy creatures can hardly be described. No change in its recurring miseries is noticeable save the transformation which comes over their little world with the return of the seasons. . . .

Since the establishment of the station only one white man has been incarcerated upon it. He was shunned by his Mongolian fellow-sufferers, and, as in a community of this kind, the patients are dependent upon one another for mutual assistance, *the white victim speedily sank, from neglect and loneliness.* . . .

The station is maintained on the principle of the strong helping the weak (!).

The supplies, *including the coffins,** are placed in a storehouse, and each man helps himself as necessity requires. Ernest Hall and John Nelson (Dominion Med. Monthly and Ontario Med. Jour., Dec., '98).

[*All italics are mine. C. E. DE M. SAJOURS.]

In the Leper Colony at Robben Island the lepers receive almost no medical at-

tention, owing to the neglect of the medical officers. Transportation thither is practically equivalent to imprisonment for life. Protest against such methods of caring for these unfortunates. Jonathan Hutchinson (Med. Press and Circular, Sept. 26, 1900).

Such neglect on the part of municipalities — such wretchedness — is not compatible with modern civilization. Sanitary regulations to protect communities involving the sequestration of innocent sufferers should not destroy with one hand to save with the other. All should come in for their share of the benefits, if equity is to prevail and if the cruelties of the dark ages are not to be perpetuated. Consumptives, inebriates, the insane, etc., enjoy all the advantages of well-appointed and comfortable sanatoria; so should the leper receive his share of all that human compassion can afford to relieve him of physical sufferings and of the mental torture that ostracism entails.

A sanatorium for lepers should, in the light of our present knowledge, be conducted much on the same lines as one for consumptives: scrupulous cleanliness, pure air and sunlight, *strict attention to the destruction by fire or antiseptics of all substances containing bacilli*, especially the secretions of the mouth and nose and the discharges originating from tuberculous nodules. With abundant wholesome food, comfortable surroundings, distraction, and constant professional care, the lives of these victims could be made bearable; the fetters which sanitary rulings impose upon them would hardly be felt, and many would be returned to their homes.

[At the Leper Hospital of Maracaibo (Venezuela), in charge of Dr. Flores, a very laudable effort, sustained by the government and private initiative, to render the life of these unfortunates bearable, has been made. The success

met with is thus described by our faithful consul in that city, Hon. E. H. Plumacher, who has repeatedly visited the sufferers and inquired into their general welfare:—

“The interior arrangements of the island are excellent. Capacious cisterns insure a supply of fresh water, and the diet is wholesome and abundant, the cost of the maintenance and treatment of each person amounting monthly to about thirteen dollars in American money. A comfortable building has been erected for the use of the employees, while for the patients a large edifice, built of concrete, forming a parallelogram with a courtyard in the centre, is divided into separate apartments, plainly, but sufficiently furnished. A neat chapel has been recently built, where religious service is held every Sunday. A pleasant feature is the establishment of cottages with grounds, in which reside those patients whose means permit of it. Land is given free to anyone who is able to erect a dwelling, and, as there are many who possess an income, little homesteads are soon formed.

“It was at first a mooted point as to whether marriages should be permitted among patients, but the question was decided affirmatively, and several weddings took place. For years the theory of sterility was not contradicted by experience, and seemed about to be definitely settled, when two births occurred on the island, the parents in each case being lepers. I would be inclined to ask whether a mistake had not been made in the diagnosis of one or the other of the parents, confounding with true leprosy some other physical taint.

“With the establishment of matrimonial relations and the system of separate cottages for those who desire them, the island is beginning to assume the aspect of a rural municipality. Its extent is little more than a mile square, with good soil, of which advantage has been taken by the well-to-do patients for the cultivation of various products and the breeding of goats. The territory has been artificially stocked with game, which is now becoming abundant, and nothing seems to have been omitted to secure the

comfort and welfare of the unfortunates. A library is at their constant disposal, and occasional musical entertainments are furnished by the Junta, whose efforts seem directed to the establishment of a *veritable home for the patients, where they may, as far as possible, forget their afflictions and pass their lives in cheerfulness*. Weekly visits of relatives and friends are allowed, which are looked forward to with eager anticipation, and the discipline generally is mild and judicious.” C. E. DE M. SAJOURS.]

As to the immigration of lepers into the country, Dr. Bracken, of Minneapolis, basing his opinion upon a study of the Minnesota colony, suggests that the family history of all immigrants from a country where leprosy prevails should be secured before they are allowed to embark for America, no member of a leprous family being permitted to land upon our shores. This procedure would doubtless prove effective were it properly carried out; but, as recently shown by Hansen, in answer to Ashmead, who recommends the same measure, the symptomatology of the disease in its early stages and the necessity of examining the entire body of each passenger would defeat any attempt in this direction from the start.

The conditions antagonistic to the spread of leprosy in Minnesota are also opposed to sterility, as borne out by the families of several of the Minnesota lepers. Dr. Bracken believes it quite possible for leprosy to die out in certain favored sections of the country, such as Minnesota, without segregation, provided the importation of lepers is discontinued; but he contends that segregation should, nevertheless, be insisted upon in all cases.

Attempts to cultivate the bacillus on leprous material made during the four years under review have always failed. In inoculation of animals the bacillus was found in the lymphatic glands situated at a distance from the seat of

inoculation. Ninety-seven cases of leprosy which left the hospital apparently cured followed up. In some a cure appeared to have been effected, but the number of these estimated at 30 at the most. Lie (Brit. Med. Jour., Jan. 26, 1901, from *Lepra*, vol. i, Fasc. 1 and 2).

Treatment.—If, as is now believed by Morrow, Hansen, Sticker, and others, “the vehicles of the virus through which contagion is affected in the vast majority of cases are the secretions of the mouth and nose,” while “the port of entrance is the mucous membrane of the respiratory and intestinal tract with secondary infection through the blood or lymphatic system” (Morrow), attention to the nasal cavities, the mouth, and throat is of primary importance.

Attention drawn to the importance of the nasal treatment, not only on account of the patient himself, but also in order to prevent the spread of the disease. Sticker (*Münch. med. Woch.*, Nos. 39 and 40, '97).

The normal secretions of the nasal cavities are alkaline and of a higher specific gravity than water; hence, the use of the latter as detergent is painful and irritating to the mucous membrane. Any liquid used for this purpose should at least possess the alkalinity and specific gravity represented by 1 drachm of common salt to 1 pint of water. As a wash, the following mixture can be confidently recommended after extensive trial in disorders of the upper respiratory tract:—

℞ Borate of sodium,
Bicarbonate of sodium, of each, $\frac{1}{2}$ drachm.
Fluid extract of Canadian pine, 1 drachm.
Glycerin, 2 drachms.
Water, 1 pint.—M.

This may be used with an atomizer producing a coarse spray night and morning, the cavities being thoroughly

drenched. In large colonies under municipal management borax and bicarbonate of sodium, equal parts, may be procured in bulk and dealt out to patients with instructions to use 1 teaspoonful of the powder to a pint of lukewarm water. An economical way is to inhale the solution from the hand, using the latter as scoop. When ulceration is present, the local treatment for syphilitic rhinitis (*q. v.*) is indicated. The secretions, as already stated, should be destroyed, and the use of spit-cups rigidly enforced.

Segregation where lepers have previously lived without resorting to such precautions should be avoided.

Cleanliness of the surface should be carried to its maximum possibility compatible with the patient's strength. As a curative measure, Baelz, of Tokio, recommended 3 to 5 strong mineral baths at 45° to 53° C. a day for a period of about one month. His results were excellent. Sea-bathing was extensively used, and with marked advantage, during the early part of the century. At first warm sea-water baths were given, until all “scaly incrustations” were removed; after this “a cure was soon obtained, especially in young persons, by bathing in the open sea” (Willan).

Among the internal remedies recommended by dermatologists, chaulmugra-oil (see description in volume ii) may be said to hold the first place. The results obtained from its use have been varied, but, assisted by the prophylactic measures outlined above, its usefulness will probably be vastly increased. It has been administered in doses of from 10 to 200 drops. By beginning with small doses and gradually increasing the quantity given, the gastric disorders occasionally following its use may generally be avoided or at least retarded until active benefit is procured. It is borne

more easily by lepers than by healthy subjects, and its use can be continued years, if need be. Many cases have been reported in which permanent cure had been obtained.

Tonics may be given at the same time. These agents, especially arsenic and strychnia, are of practical importance by tending to overcome the general adynamia.

Experiments upon 18 patients as to value of chaulmugra-oil show increase of perspiration, decrease of tubercles, improved appetite and sense of well-being, increase of sensation and increased suppleness of skin, and lessening of pains in the joints. The oil was not administered in capsules, but drunk pure. The dose used was $\frac{1}{2}$ to 1 drachm daily. Creolin used with excellent results, as a palliative and tropical remedy. Beaven Rake ("Annual Report on Leprosy and the Trinidad Leper Asylum," '90).

Lepers treated with large doses of chaulmugra-oil, either by intramuscular injections or by the mouth, may show so much improvement as to be considered cured. More frequently the disease continues to show itself, but usually in a benign manner. In some cases marked local and general exacerbations occur in spite of the treatment. The effect of the chaulmugra-oil, although beneficial, cannot be compared with that of mercury and iodine in syphilis or of quinine in malaria. The hypodermic method is to be preferred if it is well borne; it is, however, a painful method. Hallopeau ("Lepra," vol. ii, fasc. 2, 1901).

Gurjun-oil, obtained from the *Dipterocarpus lævis*, a tree growing in eastern India, has also been considerably used, with varying results. It is given internally in capsules or in emulsion with lime-water, the dose of oil varying from 1 to 3 drachms. It is especially indicated in the anæsthetic form. The same solution is also applied over leprous sores as a dressing. Better results have been obtained by Phillippo, by the use of the

latter externally and chaulmugra-oil internally.

Ichthyol has been strongly recommended by Unna, who gives about 10 grains a day in divided doses. Ichthyol-soap or the pure drug may also be employed locally. Pyrogallic acid and chrysarobin have also been recommended by Unna.

Cure of a Brazilian leper by Unna's method. Both legs and feet were rubbed with a 10-per-cent. pyrogallic-acid ointment, and the rest of the body with a 10-per-cent. chrysarobin ointment, twice daily. The face was covered with a strong creasote plaster-mull once a day, the jaws, however, being painted with zinc gelatin. Later, the larger tubercles were cut out and the patient given ichthyol internally. The patient recovered by the end of two or three months. Dreckmann (Berliner klin. Woch., Apr. 29, '89).

Crocker has recently used corrosive sublimate hypodermically. A Pravaz syringe-ful of the solution, varying in strength according to age, is injected into the buttock once a week. Europhen, thyroid substance, salicylic acid, and airol may also be mentioned among the remedies meriting a trial.

Europhen successful when given a long time every day or every other day subcutaneously:—

R. Europhen, $7\frac{1}{2}$ grains.

Oil of sweet almonds, $2\frac{1}{2}$ drachms.

Filtered and sterilized during twenty-four hours. Goldschmidt (Revue de Thér. Médico-Chir., Jan. 15, '95).

Two cases of leprosy treated by the thyroid-gland substance in both of which there was considerable improvement in the local lesions and general condition. C. B. Maitland (Lancet, Oct. 31, '96).

The following method is recommended:—

1. Local treatment with a 20-per-cent. salicylic-acid salve. This is applied over the diseased spots after having been rubbed with pumice-stone.

2. Administration of large doses of oleum gynocardiæ, $3\frac{3}{4}$ drachms.

3. Strong mineral-baths, 45° to 53° C., from 3 to 5 baths a day for a period of about one month. E. Baelz (*Berliner klin. Woch.*, vol. xxxv, Nos. 46, 47).

Six cases of leprosy treated by injections of cacodylate of soda. Injections were made daily for several weeks, as a rule. The dose was 5 centigrammes ($\frac{1}{12}$ grain). Four cases were tubercular leprosy and two nerve leprosy. All improved in general health and gained weight. In four cases there was rapid healing of ulcers. The drug is not a specific against leprosy, but a useful therapeutic agent. Raynaud (*Jour. des Mal. Cut. et Syph.*, Dec., 1901).

Intra-muscular injection of mercury-perchloride as an adjuvant to good feeding and careful general attendance found valuable. Perchloride of mercury and common salt, of each grain $\frac{1}{4}$ dissolved in 20 minims of distilled water, was injected twice weekly in 100 cases. The injection causes pain and an indurated lump locally. No abscess was observed, and in only one case profuse salivation. Neish and Tonkin (*Bristol Med.-Chir. Jour.*, Mar., 1904).

Two cases of leprosy successfully treated with intravenous injections of perchloride of mercury. The first case was that of a man of 28, with tubercular leprosy of twelve years' standing. He presented ulcers on both legs and the nasal mucous membrane, and hyperæsthesia of the extremities. In fifty days he received twenty-five injections of 5 milligrams of sublimate. After this treatment all the ulcers healed. After several months three fresh ulcers appeared on the legs; these healed after twelve more injections. The second case, a man of thirty, was one of anæsthetic leprosy, with also extensive ulceration of the nasal cavity and ulcers of the legs. After twenty injections most of the ulcers healed, and the rest were healing; the anæsthesia was also much improved. Luga (*Bull. Med.*, Apr. 1, 1903).

Tuberculous nodules may be destroyed by galvanocautery or thermocautery followed by local antiseptic lotions. If this procedure is objected to, their absorption

may sometimes be obtained by local applications of iodine or mercurial ointment. Besnier uses with success in tuberculous cases a form of treatment combining several measures.

Internal treatment (chaulmugra-oil, up to 300 drops; salol, up to 5 grammes daily) perseveringly administered. Each tubercle is cauterized interstitially by means of single or multiple points, or by electrocaustic bars when the surfaces to be destroyed are large. After cauterization should follow daily spraying with weak carbolic-acid water and dressing with sublimate or iodoform gauze, together with the management of cicatrization by means of nitrate-of-silver or zinc pencils. The same galvanocautistic application should be made to all affected points of the mucous membranes of the lips, nose, mouth, tongue, and pharynx. By their means it is quite easy to check and destroy the leprous foci so common in all these parts, and the results obtained are very remarkable. E. Besnier (*Univ. Med. Mag.*; "Pictorial Atlas of Skin Dis.," etc., Part IV, '96).

Subcutaneous injections of chaulmugra-oil beneficial. At first it was administered by the mouth, 30 to 35 drops for a dose, but the nausea and vomiting to which it gave rise caused subcutaneous injections of 75 minims of the sterilized oil to be substituted. During six years five hundred and eighty-four injections were given, and the patient appeared to be cured. T. Bey (*Indian Med. Record*, June 13, 1900).

In a case successfully treated by Besnier in the manner just outlined, the patient, unknown to his physician, had also taken for a period of three years chlorate of potassium, 15 grains three times a day. Interesting in this connection is the following observation by Carreau, and the results obtained by Dyer with Calmette's antivenine.

The antivenomous serum of Calmette, of Lille, was employed by Dr. I. Dyer, of New Orleans, in the treatment of lepers, with promising results. It was

injected under the skin with a Pravaz antitoxin syringe. The dose varied from 15 minims to $2\frac{1}{2}$ drachms. The injections were made every second day at first, subsequently every day. The parts of the body selected for injections were in the gluteal muscles and the skin in this region, the interscapular spaces, and, exceptionally, the leprous lesions themselves.

In a case of leprosy Calmette's *sérum antivénéneux* was administered subcutaneously by means of a Pravaz syringe, —as a rule, in the loose tissue of the interscapular region and in other selected places. In addition to the serum, the patient was kept on large doses of hoangan during the entire treatment. The patient was treated with antivenomous serum from August 19th to October 17th, during which time 500 cubic centimetres of serum were used in forty-seven injections. Maximum injection, 20 cubic centimetres; minimum, 2 cubic centimetres.

The present condition is one of great improvement. All over her face and ears there is a marked loss of infiltration. The bluish color of her face has changed to a healthy red. Her eyes are clear and bright. There are no sores on any portion of her body. There is only one tubercle remaining, and this has proved somewhat obstinate, despite frequent local injections. Her anæsthesia has disappeared and her skin has become softer and fairer. She has gained fourteen pounds in weight, and her general health is excellent. R. S. Woodson (Treatment, Jan. 11, 1900).

In four out of the five cases in which this procedure was resorted to marked improvement was obtained.

Serum-therapy has been tried by Carasquilla in one hundred cases with "good results," but the method has not, as yet, received sufficient trial to merit more than a mention. The same may be said of Merck's serum, tubercle-juice, and Coley's erysipelas toxins recently tried.

Horses immunized with blood-serum from lepers by injecting 15 to 60 cubic centimetres every ten days on three occasions, and ten days after the third injection the serum is taken. The serum, taken with great care, is then employed as follows: In a leper from whom blood to the amount of 150 to 250 cubic centimetres has been drawn, 1 to 5 cubic centimetres of horse's serum is injected after five days; a second injection is made three or four days later, according to the degree of reaction, then a third and a fourth; in some subjects reaction does not take place till after this period. The reaction manifests itself by fever, circulatory disturbances, changes in the secretions, etc. After some days the leprous lesions undergo somewhat rapid modification; the tubercles desquamate and shrink, the ulcerations become vegetating and cicatrize. The disturbances of sensibility are lessened, and, when the lesions are not too far advanced, improvement takes place rapidly, and to an astonishing degree. One hundred cases treated by this method with good results. Carasquilla (Brit. Med. Jour.; Correio Med. de Lisboa, xxv, 122, 124, '96).

Case of maculo-tubercular leprosy treated with Carasquilla's serum.

Between February 7 and June 9, '97, twenty-six injections of serum were made into the buttocks; 0.2 cubic centimetre was first used, and this was increased up to $3\frac{1}{4}$ cubic centimetres. The injections were given at first twice and then once a week, and later there were at least two pauses of fourteen days. A local reaction occurred, most marked on the evening of the day of injection, and disappeared in a few days. Usually there were no unpleasant general symptoms.

Redness and swelling, with subsequent absorption, occurred in the leprous nodules, and there was considerable diminution in the infiltration of the tissues. A new growth of hair appeared on the extensive patches of alopecia upon the head. Leprous ulcers in the mouth healed. Patient's condition underwent, in every way, a marked improvement. During the four months after the injections there was some tendency to relapse, but these relapses were much milder than formerly. The results obtained were much better

than under any other treatment. Buzzi (*Brit. Med. Jour.*; *Deut. med. Woch.*, Oct. 14, '97).

Merck's serum was employed about six months. The first patient received, in all, eighteen injections, and the other twenty, and in addition to these, each was given the serum on three occasions by the mouth. The injections were made into the abdominal wall midway between the anterior superior iliac spine and the linea alba. A diphtheria-antitoxin syringe was employed. The total amount of serum injected was, in the first case, 4 ounces and in the second 5 ounces. The initial dose was $\frac{1}{2}$ drachm, and the quantity was gradually increased until $2\frac{1}{4}$ drachms were injected at once. Decided improvement took place in both patients under the treatment. Amelioration persisted to the time at which the paper was written, namely: two and a half months after the cessation of treatment. A. Grünfeld (*Derm. Zeit.*, B. 5, H. 3, '98).

Four cases of leprosy subjected to treatment with the toxins of erysipelas. The initial dose was one minim of Coley's preparation of the toxins of erysipelas and of the bacillus prodigiosus, and this was gradually increased until near the close of the experiment in each case a dose of 22 minims was reached.

Conclusions reached are: (1) injections of the toxins of erysipelas have no effect on the course of leprosy, and (2) the system may tolerate large and continued injections if the dose is gradually increased. Henry Dwight Chapin (*Phila. Med. Jour.*, Dec. 31, '98).

Use of Haffkine's prophylactic on a nodular leper child; the usual reaction followed, and no fresh tubercles have appeared for nearly two years. Lee (*Indian Med. Gaz.*, May, 1900).

Beaven Rake, of Trinidad, has employed nerve-stretching. He found that the great sciatic was the most satisfactory nerve to stretch, being near the spinal ganglion, while it commands the supply of the whole leg and foot and the back of the thigh. The chief indications for the operation are perforating ulcer; some cases of necrosis; pain, whether asso-

ciated with the perforating ulcer or with peripheral neuritis. More or less relief was given in one-half the one hundred cases operated upon.

During the four years the following drugs were tried: Europhen, in a 5-per-cent. oily preparation, rubbed in three times a day, gave no result in 3 cases. Airol as an ointment failed, but as a 10-per-cent. emulsion injected into the nodules some local benefit ensued, but the disease generally was not influenced. Syncope followed the injections in some instances. Unna's oxidized pyrogallol as a 5-per-cent. solution gave rise to gastric symptoms, and did no good. Three lepers were treated with Carasquilla's serum (Merck) without benefit. As a drawback asphyxial attacks were observed. Lie (*Brit. Med. Jour.*, Jan. 26, 1901, from *lepra*, vol. i, Fasc. 1 and 2).

Ichthyol, beginning with 30 to 45 grains (2 to 3 grammes) a day, reaching $2\frac{1}{2}$ drachms (10 grammes) a day in a short time, gave rise to no unpleasant by-effects, and proved effective in the tubercular form of leprosy. In the neurotic form it was inefficacious. The tubercles and nodes became softened and were absorbed very rapidly under the influence of ichthyol in one to two months, and the ulcerations healed very rapidly. There were no relapses and no new formation of tubercles. Ichthyol must be administered internally; applied externally, it proved of no avail. De Brun (*Bull. de l'Acad. de Méd.*, 1901).

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LEPTOMENINGITIS. See **MENINGITIS**.

LEUCORRHŒA. See **UTERUS**, **VAGINA**, and **INDEX**.

LEUKÆMIA.

Definition.—Leukæmia is a disease characterized by a marked excess of lymphatic tissue in the body, by a peculiar excess of circulating white corpuscles,

and wide-spread and varied symptoms of toxæmia, with the frequent presence of mechanical symptoms of pressure.

Varieties.—There are three types of the disease, considered from both the pathological and clinical points of view: myelogenous, or leucocytic; lymphatic, or lymphocytic; and mixed leukæmia. The myelogenous and lymphatic types are chronic in their course. The mixed, or myelolymphatic, type is but rarely chronic, is usually acute, and comprises the special group of acute leukæmia.

Symptoms.—**SYMPTOMS OF CHRONIC LEUKÆMIA.**—The onset of chronic leukæmia is usually gradual. The symptoms are best summarized by systems.

The skin may rarely appear normal in color; in some cases it is very white; in most cases it is of a dull-yellow hue. Petechiæ, accidental eruptions, and areas of pigmentation or of loss of pigment are common. There is a sudoral type. Pruritus and paræsthesiæ are often noted. Œdema may occur, of four types: cardiac, anæmic, due to venous compression, and the peculiar form due to obstruction of the lymphatic channels.

Stomatitis and tonsillitis are very common, and may pass to ulceration, from whence hæmorrhage is apt to occur. Anorexia or perversion of appetite is seen in most cases. Vomiting is frequent; distress after meals, regurgitations, and eructations are almost constant. Diarrhœa is seen oftener than constipation, and in the cases with ulceration is persistent. Hæmorrhoids are not uncommon. Abdominal tenderness is often noted. The enlargement of the liver can be usually demonstrated; it is hard and smooth and may be tender. Ascites is uncommon. Jaundice is sometimes seen.

Rapid cardiac action is the rule. The

pulse is full and of low tension; the capillary pulse is often present. The heart is rarely enlarged, but may be displaced by the spleen, liver, or mediastinal gland. The first sound often lacks the full muscular note. Systolic hæmic murmurs are common at the base and at the apex, while the venous hum in the neck is still more frequent.

Hæmorrhage into the skin and from the mucosæ are frequent, and may be spontaneous or induced by slight injury.

Case of leukæmia in which hæmatoma suddenly developed in the right axilla, and extended downward to the sixth rib and from the nipple to the vertebral groove. Hale White (*Lancet*, June 9, '88).

Case of acute leukæmia in which there was an attack of hæmoglobinæmia, hæmoglobinuria, and icterus, with fever and gastric disorders. The patient slowly recovered, but, after several months, succumbed in a second attack. Englehardt (*St. Petersburger med. Woch.*, May 2, '92).

Seven cases of leukæmia, including chronic lymphatic and mixed types, and one complicated by a pernicious anæmia. All the patients were males; a history of trauma to the splenic region could be elicited in three, while in the others rheumatism, nervous influences, and malaria probably played an important rôle. In the traumatic cases the onset was more or less sudden. The following symptoms deserve special mention: Initial hæmoptysis and enormous hæmorrhages from the nose, fever due to constipation or complications, albuminuria, œdema and ascites in the later stages, and very marked swelling of the spleen and lymph nodes. P. Reekzeh (*Zeitschr. f. klin. Med.*, vol. 1, Nos. 1 and 2, 1903).

A slight polyuria is often seen. The urine often contains an excess of urobilin. Albumin does not usually indicate nephritis. Albumoses may be found. A few leucocytes and hyaline casts are often to be found in the sedi-

ment. Some cases have frequent hæmaturia.

A fatal case of medullary leukæmia in a girl, 14 years old, the most striking post-mortem change being a diffuse leukæmic infiltration of the kidneys. Fränkel (*Deut. med.-Zeit.*, Nov. 13, '90).

Priapism is an occasional symptom, due to infiltration of the corpora cavernosa. Leukæmia does not produce impotency. The menstrual function is usually deranged, and there is a tendency to much bleeding.

Case of leukæmia in which there was priapism with cessation of sexual excitement. The autopsy showed that the corpora cavernosa had become transformed into homogeneous connective tissue. Kast (*Zeit. f. klin. Med.*, B. 8, H. 1, 2, '95).

Dyspnœa is almost constant and does not depend entirely on the anæmia, but is, in part, toxic. Œdema of the glottis or of the lungs may occur. Laryngeal ulcerations may produce grave danger, as may mediastinal or cervical pressure. Pleural effusion is rare. Epistaxis is common.

Leukæmia changes in the larynx and trachea usually consist of numerous small nodules in the mucous membrane of the larynx and respiratory mucous membranes, or less frequently slight diffuse infiltrations. Ebstein (*Wiener klin. Woch.*, s. 462, '96).

Case of leukæmic infiltration of the larynx. At the autopsy there was found perichondritis of the arytenoid cartilage in addition to the leukæmic infiltration. The periosteum in the right half of the larynx was evidently partly infiltrated by the leukæmic and partly by a simple inflammatory process. In the left half the infiltration was purely leukæmic. Mager (*Wiener klin. Woch.*, No. 26, '96).

Changes in the larynx and in the trachea in cases of leukæmia. Case of a boy, aged 13 years, who had attacks of severe dyspnœa, with croupy cough. Laryngoscopical inspection revealed great thickening of the ventricular bands, and infiltration of the whole upper portion of the larynx. The child died with severe

dyspnœa, aphonia, and bleeding from the mouth and nose. On post-mortem examination it was found that the infiltration of the larynx and bands was due to a dense collection of lymphocytes in the submucous tissue. The capillaries, also, were distended with lymphocytes, and these cells were especially abundant in the interglandular spaces. The submucous tissue in the trachea was affected in the same way. Otto Barnick (*Münch. med. Woch.*, Apr. 19, '98).

The temperature is rarely normal for any length of time, a low irregular fever being seen at some period in most cases. Chills rarely occur, but may be without significance.

Case of leukæmia under observation for three and a half months; there was daily rise of temperature followed by a gradual fall during the whole period. Von Hajek (*Wiener klin. Woch.*, May 20, '97).

Exophthalmos may be produced by post-orbital collections. Leukæmic retinitis occurs in many cases, often accompanied by retinal hæmorrhages; it may cause no symptoms, or may produce amaurosis. Dimness of vision may be present without retinal lesions. Tinnitus aurium and vertigo are common; deafness may be rarely due to hæmorrhage into the internal ear.

Three autopsies in which it was determined that exudations and hæmorrhages in the middle and internal ears were the cause of ear disease in leukæmia. Lannois (*L'Union Méd.*, Feb. 16, '91).

Case of leukæmia in which sudden vertiginous attacks simulating Ménière's disease occurred. Subsequent anatomical examination disclosed a fibrinous collection in the utricle and saccule of the vestibule, with here and there more decided evidences of hæmorrhage. Lannois (*Lyon Méd.*, Jan. 3, '92).

Aural lesions appeared in 10 male and 5 female patients suffering from leukæmia. The aural affection took the form of more or less pronounced deafness, usually tending to rapid aggravation, and accompanied by tinnitus, and often

vertigo. In a certain number of instances these symptoms constituted Ménière's triad. The anatomical lesions consisted in the accumulation of leucocytes, and the occurrence of hæmorrhages both in the medullary spaces of the petrous bone and other parts of the auditory apparatus, and particularly in the internal ear. Schwabach (*Zeit. f. Ohren.*, '97).

Case of leukæmia presenting a peculiar affection of the eyelids, which at first had the aspect of œdema, but on closer examination proved to be small lymphatic tumors which were not adherent to the skin. Litten (*Med. Bull.*, Mar., '97).

Case of leukæmia complicated by hæmorrhage into the anterior chamber of the right eye. Sorger (*Münch. med. Woch.*, Aug. 30, '98).

Headache, insomnia, neuralgic pains, and depression are almost constant. Delirium may occur, toxic in origin; coma, when present, is usually due to intracranial tumor or hæmorrhage. Peripheral neuritis is uncommon.

Case of leukæmic bulbar paralysis. Kast (*Zeits. f. klin. Med.*, B. 8, H. 12, '95).

Two cases of disease of the spinal cord due to leukæmia. In the first microscopical examination of the cord revealed small myelitic foci, or, more strictly speaking, foci of acute or subacute nerve-degeneration, scattered through the white substance from the upper lumbar region to the medulla oblongata. Some of these degenerated points were large enough to be seen by the naked eye, and all stages of degeneration were to be observed, from a simple puffed-up appearance of the myelin sheath and swelling of the axis cylinder to segmentation, breaking up, and disappearance of the nerve-fibres, with compensatory hypertrophy of the neuroglia. Changes in the vessels, hæmorrhages, cellular infiltration, and extravasation of leucocytes were entirely wanting, and the gray matter throughout, together with the nerve-roots, were absolutely normal.

In the second case microscopical examination of the spinal cord revealed lesions identical in character, size, and distribution with those of the first case, the gray matter, nerve-roots and vessels

being intact. Nonne (*Deutsche Zeit. f. Nerv.*, Apr. 30, '97).

The spleen in myelogenous leukæmia may reach to the pelvis below and touch the liver to the right. It is hard and smooth; it may pulsate, give a friction-rub, or, on auscultation, a bruit. Splenic pain and distress are quite constant. In lymphatic leukæmia the spleen is less prominent. In all cases the enlargement is subject to fluctuations.

The lymphatic glands are inconstantly enlarged in myelogenous, but constantly in lymphatic, leukæmia. They are not hard, often tender, and usually painful. In the axillary, femoral, inguinal, and sacral regions they may press on veins, causing œdema and cyanosis, and by pressure on nerve-trunks produce great pain and even paralysis. The cervical glands especially tend to enlarge, they limit the cephalic movements, and may press upon the veins. Enlargement of the glands at the base of the tongue and of the tonsils may produce dysphagia. Enlargement of the thoracic glands may produce aphonia, bronchial or tracheal stenosis, pressure on the superior vena cava or its bronchus, tachycardia, dysphagia, and cardiac dislocation. On percussion the area of dullness is usually easily demonstrable, and an actual protrusion of the mass is occasionally observed. Enlargement of the retroperitoneal glands may produce a large retroperitoneal tumor, with dislocation of the viscera, and perhaps œdema of the legs.

Method suggested to determine enlargement of the thoracic glands: The patient is placed before the observer, the fingers thrust behind the sternum, and then the patient's head rotated. In this way the thoracic glands may occasionally be felt. Enlarged bronchial glands sometimes push the arch of the aorta up and make it palpable behind the sternum. There may be, in addition, a systolic murmur from pressure on the aorta.

Enlarged tonsils and lymphoid masses on the back of the tongue may be observed and intestinal involvement is proclaimed by intractable diarrhœa. Jaccoud (*La Sem. Méd.*, Mar. 11, '91).

Twenty-eight cases of leukæmia analyzed: In 12 cases the blood was of Virchow's lienal type, in 4 of lymphatic, and in 12 of mixed type. The spleen was enlarged in all, the liver considerably so in 10, and in 10 there was polyadenitis. In 4 the mesenteric glands only were enlarged, in 4 the cervical and thymus, in 2 the mammary, and in 2 the axillary glands. Four cases occurred in the first year of life and 3 in the seventh decade. Weber (*St. Petersburger med. Woch.*, Feb. 12, '92).

It is somewhat curious that the first symptom of which patients complain seems to depend upon enlargement of the spleen, for one would naturally expect weakness, shortness of breath, or other consequences of anæmia to attract attention at an earlier date. In 6 cases 3 complained of swelling of the abdomen and 3 of pain in the left side, while shortness of breath, weakness, sickness, loss of flesh, pallor, thirst, dyspepsia, or, more accurately, flatulence and a feeling of oppression after food have been only secondary symptoms. Epistaxis, hæmatemesis, and hæmaturia occur pretty frequently, and there may be a peculiar diarrhœa with thin, watery stools. These patients are generally anæmic-looking, but there are exceptions. Occasionally they are sallow or jaundiced. For ordinary diagnosis it is quite sufficient to obtain a drop of blood by pricking the finger and examining it under a magnifying power of 300 to 400 diameters, when the enormous increase of leucocytes can be readily recognized; but it is now usual to make a much more elaborate examination of the blood.

The red and white corpuscles are separately counted, and by the examination of stained films the various kinds of leucocytes are determined and their relative numbers estimated. Finally, the percentage of hæmoglobin is calculated by the approximation of a diluted specimen of blood to a color-scale.

Robert Saundby (*Brit. Med. Jour.*, Jan. 5, 1901).

This affection shows the following characteristics: A hæmoleucocytic formula which is generally a lymphocytosis; profound alterations in the red cells; great anæmia from the beginning; hæmorrhages; fever; hypertrophy of ganglia and spleen; sudden onset and rapid course. Leclerc (*Lyon Médical*, Feb. 14, 1904).

Pain in and tenderness over the bones exists in some cases of myelogenous leukæmia. Its absence signifies nothing.

SYMPTOMS OF ACUTE LEUKÆMIA.—Acute leukæmia presents the picture of an acute infection. There is an irregular fever, often high, and chills are frequent. Some of the lymphatic glands become acutely enlarged, but this often subsides; the spleen is only moderately enlarged. Hæmorrhages are marked symptoms, from the gums, nostrils, from the stomach and rectum, and into the skin; they persist for days, and produce a distinctive picture. Ulcerations in the mouth are almost constant, and there is often a peculiar fœtor to the breath. Diarrhœa may be present, and intestinal ulceration is common. Vomiting is frequently noted. The pulse is usually very rapid, and dyspnœa is marked.

A characteristic of acute leukæmia is the hæmorrhagic diathesis which is associated with swelling of the glands, spleen, and liver, and with peculiar blood-changes. Twelve cases personally seen in seven years. Many cases were mistaken for purpura hæmorrhagica until the blood-examination revealed their true nature. Typical heteroplasmic leukæmic growths occur in the liver and spleen. The blood-changes are entirely characteristic. There is a remarkable increase of the mononuclear elements, which are of the most varying sizes, but do not contain neutrophilic granules. A. Fraenkel (*Deutsche med. Woch.*, July 1, '97).

The disease is probably more frequent than is generally supposed. Fraenkel met it once in every 2620 cases of disease

that came under his observation. The chief diagnostic points are the hæmorrhagic tendency, rapid anæmia, fever, ulceration in the mouth, moderate glandular and splenic enlargement with the characteristic blood findings; and of all these the blood changes are most important and must be relied upon for the diagnosis. On account of the moderate leucocytosis which may exist in patients presenting the above symptoms-complex, stained specimens should be made and a differential count will soon determine a marked disturbance of the normal proportion of various cells present or the appearance of myelocytes in large numbers if a leucæmia exists. So far all forms of treatment have proved ineffective. At times a remission in all the symptoms will occur. Ordinarily the duration of the disease is from four days to sixteen weeks. Miller and Hess (*American Medicine*, Mar. 5, 1904).

A low delirium develops in most cases, passes into coma, and death occurs in from a few days to six weeks. No disease could possibly look more toxic.

Minute hæmorrhages into the brain-substance were the cause of death in a case of leucæmia. Virchow (*Deut. med. Zeit.*, Jan. 30, '88).

Case in which epistaxis was the cause of death. Knipp (*Maryland Med. Jour.*, Nov. 17, '88).

Case of acute leucæmia in which the fatal event was precipitated by a puncture of the spleen, which was made for diagnostic purposes. A. Westphal (*Münchener med. Woch.*, Jan. 7, '90).

Prognosis.—As just stated, the duration of acute leucæmia is from a few days to six weeks. The *duration* of *chronic leucæmia* varies from one to four years, though longer cases have been recorded. Death may be directly due to some of the symptoms, to exhaustion, or to intercurrent disease.

Case of acute leucæmia following influenza, which terminated in three days. Litten (*Münchener med. Woch.*, Apr. 26, '92).

In cases of leucæmia complicated by various septic processes, considerable improvement, at least in the leucocytosis, occurs as the infection develops. Marischler (*Wien. klin. Woch.*, July 23, '96).

The prognosis as to life in leucæmia is hopeless; certain cases manifest remissions, but ultimately go on to a fatal issue. M. L. Goodkind (*P. and S. Plexus*, Apr., '98).

Case of acute leucæmia in a child 3 years old ending fatally thirteen days after the onset of illness. J. L. Morse (*Arch. of Pediatrics*, May, '98).

Diagnosis.—Chronic leucæmia in the active stage can always be diagnosed by a careful examination of the blood. In periods of quiescence of the disease, however, the blood may, for a time, not present the characteristic signs. It is the quality, rather than the quantity, of the leucocytes which characterizes leucæmia, though nearly all cases present a number of leucocytes never seen in the known forms of simple leucocytosis. In very rare instances the diagnosis from pseudo-leucæmia and sarcoma may be impossible. In children with secondary anæmiæ, enlarged spleens, marked oligocythæmia, pronounced leucocytosis, and some myelocythæmia, the diagnosis from leucæmia presents at times great difficulties. Acute leucæmia resembles the purpuræ of violent type, and the blood of all purpuric patients should be examined for leucæmia.

Blood of two cases of acute leucæmia examined. At a period of temporary improvement in one of the cases an ordinary examination of the blood would have failed to discover any leucæmia; whereas by Ehrlich's methods, the appreciable percentage of typical myelocytes found would at once arouse suspicion, even in the absence of leucocytosis. Thayer (*Johns Hopkins Hosp. Bull.*, May, June, '91).

In acute leucæmia anatomical lesions may antedate the changes in the blood by a considerable time. Kast (*Deut. med. Woch.*, Oct. 29, '91).

The varied character of the leucocytes regarded as of the greatest importance in distinguishing between leucocytosis and leukæmia. The myelocyte of Ehrlich may be a valuable diagnostic feature, but one which is frequently wanting. Troje (*Deutsche med. Woch.*, Apr. 21, '94).

Case of leukæmia in which the implication of the lymph-glands occurred with, what is usually considered, a typical myelosplenic blood-condition. It seems, therefore, that the blood-examination does not suffice to distinguish the types. Musser and Sailer (*Trans. Assoc. Amer. Physicians*, '96).

Case of lymphatic leukæmia in which the lymphocytes were found to contain sharply-circumscribed colorless bodies which showed amœboid movements even when cold. They were believed to be protozoa. Mannaberg (*Centralb. f. innere Med.*, Apr. 25, '96).

There are only two forms of leukæmia: (a) Lymphæmia; the blood shows an increase of white cells of the type of lymphocytes. (b) Leukæmia proper; the blood presents an increase of white cells of the type of leucocytes in the wider sense—cells presenting all possible variations between the size of the nucleus and the size of the cell-body. The increase of the eosinophile-cells occurs generally only in leukæmia proper, exceptionally in lymphæmia. The characteristic feature of the leukæmic blood as against that in leucocytosis is the polymorphism of the white cells. Weiss (*Hämatologische Untersuchungen*, Vienna, '96).

Acute leukæmia may be diagnosed by the occurrence of a rapidly-increasing anæmia, with its accompanying symptoms, petechiæ over the body, or hæmorrhages from the mucous membranes, with enlargement of the lymph-glands, fever, and a moderately enlarged spleen and liver, accompanied by a decrease in the blood of the red cells and an increase of the white cells of mononuclear form. M. H. Fussell and A. E. Taylor (*Phila. Med. Jour.*, Jan. 7, '99).

The distinction between acute and chronic leukæmia should be based upon the character of the onset; this in the acute form is always sudden, while in chronic leukæmia the same symptoms de-

velop late. These symptoms are weakness and prostration, headache, stomatitis, pains in the limbs, sometimes difficulty in swallowing, hæmorrhages in the skin and from the mucous membranes, and sometimes hæmorrhages into the brain. The blood shows a marked increase of mononuclear leucocytes, nucleated red corpuscles being rare. A. Denig (*Münchener med. Woch.*, Sept. 18, 1900).

Etiology.—The etiology of the disease is probably concerned with a micro-organismal infection, the nature of which has not been determined; nor has the portal of infection been made out. For the numerous parasites of which a causal relation to leukæmia has been postulated no convincing pathogenicity has been demonstrated: they have, in all instances, been examples of accidental or terminal infection. The morbid changes and the symptoms almost indubitably suggest an infection.

The conditions which influence the prevalence of the disease are obscure. Two-thirds of the cases are in males. The majority of cases occur after puberty and before the age of fifty. Cases have been seen in the very old, however, and in infants and even in the foetus.

The etiology of leukæmia may be summarized as follows: 1. Heredity, traumatism, and preceding diseased conditions can only be of secondary importance as factors in the etiology of leukæmia. 2. Barring the possible nervous origin of the disease, which, however, has not yet been suggested, the possible explanations of its etiology seem to be limited to three: *a.* That it is due to a vice in the internal processes of cell life and division that comes into generalized activity and results in exaggerated leucocytic hyperplasia. *b.* That it is the result of toxic substances of unknown origin. *c.* That it is of infectious or parasitic origin. This latter theory is the only one that has been the subject of direct investigation. The results have not confirmed

the theory. The explanation of the causation of leukæmia would therefore seem to lie between the toxic theory and the hyperplastic theory, with the probabilities, perhaps, in favor of the former. It also remains to be shown whether there is but one specific cause for the different forms of leukæmia. Nichols (*American Medicine*, July 18, 1903).

From different sources stress has been laid upon the possible predisposing influence of the infections, especially malaria, of pregnancy and lactation, of traumatism, and, in children, of rickets and syphilis.

Several cases have occurred in a family. There has been one published case which was apparently acquired by contagion. In a few instances pernicious anæmia and pseudoleukæmia have seemed to terminate in true leukæmia.

Cause of leukæmia is an amœba, two varieties representing the two main forms of the disease. In the lieno-myelogenous variety there is a large form of the organism personally called "*hæma-mœba leukæmia magna*." In lymphæmia another form of amœba is found, termed the "*amœba leukæmia vivax*." The first variety is found both in the peripheral blood and in the blood-forming organs. In lymphæmia the amœba is found but rarely in the peripheral blood, but in large numbers in the blood-forming organs. In some cases of leukæmia both forms of amœbæ are found, constituting a mixed infection. Löwit (*Centralb. f. Bact. u. Parasit.*, Nos. 8 and 9, '99).

None such organisms as those described by Löwit found. The large general increase in leucocytes or of the mononuclear elements afford strong evidence against the infectious nature of the disease, since in infectious diseases the leucocytosis consists almost or quite exclusively in an increase of the polymorphonuclear neutrophiles. Widal (*La Semaine Méd.*, Mar. 11, 1900).

Pathology.—There are three main theories which aim to account for the lesions of leukæmia. Of the two earlier

views, the Virchow-Neumann theory considered the excess of white corpuscles due to an abnormal hyperplasia of the hæmatopoietic tissues, and most of the adherents of this view have conceived this hyperplasia as analogous to that seen in malignant neoplasms.

The evidence points strongly to the correctness of Virchow's theory that leukæmia is a disease primarily of the blood-making organs, and that the increase of leucocytes takes place in these organs. The marrow-cells, or myelocytes, believed to be identical with the cells of the marrow, and not ordinary leucocytes increased in size by hyperplasia; strong belief shown in their value as elements indicative of a myelæmic form of leukæmia, though not absolutely diagnostic. H. F. Müller (*Centralb. f. allg. Path. u. path. Anat.*, Nos. 13, 14, '94).

The mononuclear leucocyte (larger than the large lymphocyte, from which it is further distinguished by having "an excentrically situated, pale, irregularly spheroid or ovoid nucleus, and a relatively large amount of slightly basophilic nongranular protoplasm") is the mother cell, ordinarily capable of further differentiation into either the ordinary basophilic cell, or into a neutrophilic myelocyte. The two forms of leukæmia, lymphatic and myelogenous, are closely associated, and probably forms or stages of the same disease. Lymphocytes are formed in the lymphoid tissue of the bone marrow, and not exclusively in the lymph-glands as formerly supposed. Myelocytes are formed in the bone marrow, and are the parent cells of the polymorphonuclear neutrophiles. In myelogenous leukæmia, myelocytes are cast into the blood circulation in all probability because of increased activity of the myeloid tissue of the marrow, which is the only tissue primarily affected in this disease. G. H. Evans (*American Medicine*, Aug. 13, 1904).

The Bilsadecki-Löwit theory predicates a retardation in the evolution and prolongation of the life of the circulating leucocytes, the collections in the tissues being interpreted as the results of

the deposition of the excess of the circulating leucocytes. Of these two the first undoubtedly contains the primary truth,—that there is a marked hyperplasia of some or of all the resident lymphatic tissues of the body, and that the circulatory conditions are dependent thereon. In recent years the neoplastic conception has lost its hold upon investigators, who have gradually evolved the third theory: that leukæmia is an infection, and that the hyperplasia of the lymphatic tissues and the circulatory excess of white cells is the result of a specific stimulation and leucocytosis, analogous to those seen in the course of other infections. Our present knowledge of leukæmia, of the infections and the tissue-reactions to them, and of the leucocytoses strongly support this view. The primary lesions in leukæmia must be carefully separated from the secondary alterations.

A priori, the genesis of leukæmia is best accounted for by a deviation of nutrition due to a lesion of the great sympathetic or by the action of a micro-organism, and of the two hypotheses the parasitic personally preferred. Mayet (Lyon Méd., Apr. 1, '88).

Leukæmia believed to be a specific infectious disease. Westphal (Berliner klin. Woch., Oct. 7, '89).

A short, blunt bacillus found in the spleen of a person dead of leukæmia. It was not found in twelve spleens of other diseases. Fermi (Canadian Practitioner, Feb. 16, '91).

Leukæmia is due to a mitotic increase of a certain kind of leucocyte in a pathological manner as a result of the action of some cause as yet unknown. Hindenburg (Deutsches Archiv f. klin. Med., B. 54, S. 209).

Case of acute lymphatic leukæmia with streptococcic infection. Patient first had a sharp attack of sore throat, with recurrence after a week, and then rapid enlargement of the glands of the neck, axilla, and groin. The spleen was enlarged. Leukæmia had not existed prior

to the throat infection. J. B. Herrick (N. Y. Med. Rec., July 10, '97).

MYELOGENOUS OR LEUCOCYTIC LEUKÆMIA.—By myelogenous or leucocytic leukæmia we understand the type in which the hyperplasia affects the myelocytes of the marrow and the leucocytes derived from them. It is the common type. The essential change in the marrow is the so-called pyoid condition, a marked overgrowth of the myelocytes, which more or less completely replace the fatty marrow. Microscopically the tissue is chiefly composed of neutrophilic myelocytes, which in properly prepared preparations are seen to be in active reproduction and development into neutrophilic polymorphonuclear leucocytes. The eosinophilic myelocytes are also in actual excess, and mast-cells may often be seen in large numbers. The osteoplaxes are in excess, and are actively engaged in phagocytic function and contain erythrocytes and leucocytes. The lymphocytic nodes of the bone-marrow are not affected in the process of overgrowth.

The secondary lesions in the marrow consist, for the most part, of alterations in the erythrogenetic tissues. There is a marked toxic hæmolysis connected with the condition, and in the attempt to keep pace with the destruction of the red cells the red marrow undergoes a compensatory hypertrophy, it becomes splenified like the foetal marrow, just as in pernicious anæmia. This red marrow may be universal, or may appear only in scattered areas; in some cases it is entirely absent. Microscopically the red marrow presents myriads of enucleated red cells engaged in active proliferation, the macroblasts being especially prominent. Hæmorrhage and infarction may be present, as may fatty degeneration and hyaline changes.

Case of more or less pure myelogenous leukæmia. The spleen weighed 10 ounces, but the lymph-glands were not at all enlarged. Beatty (*Dublin Jour. of Med. Science*, May, '91).

The myelocytes are identical with marrow-cells, and are present in increased amount because of some abnormal activity in cellular proliferation in the marrow. Stanley (*Birmingham Med. Review*, Jan., '94).

The marrow-changes are, as a rule, the first and the essential, though subsequently often overshadowed by the splenic and lymphatic manifestations. Boyd (*Practitioner*, Aug., '94).

Case of myelogenic leukæmia in which erythrocytes presented numerous mitoses. Pick (*Berliner klin. Woch.*, No. 43, '94).

In acute leukæmia there are karyokinetic changes in leucocytes, besides great number of them. Marrow of long bones showing hyperplastic multiplication of medullary elements, that of ribs containing small number of nucleated red corpuscles. Possible indication that evolution of young lymph-cells into red corpuscles impeded. Askanazy (*Virchow's Archiv*, B. 137, H. 1, '95).

The alterations in the blood correspond to those in the marrow. The white cells number usually from 100,000 to 600,000 per cubic millimetre. Neutrophilic myelocytes constitute a large portion of the circulating white cells, sometimes more than half. Next in number are the neutrophilic polymorphonuclear leucocytes. Mononuclear eosinophiles (myelocytes) and polymorphonuclear eosinophiles are in most cases present in large numbers. The non-granulated large mononuclear cells are usually in excess. Mast-cells are seen in considerable numbers. Many of the cells of all the enumerated types present a marked polymorphism in size, shape, and appearance of nuclei; and in the number, size, and staining of the granules they vary greatly; this extreme degree of polymorphism is characteristic of leukæmia. Cellular degenerations often affect these

leucocytes, karyolysis being more frequent than karyorrhexis. The lymphocytes are usually not increased in myelogenous leukæmia; if in excess it is to a slight degree, dependent probably upon the anæmia, and the cells do not present the polymorphism and degenerations seen in the leukæmic corpuscles. Cell-division is rarely to be seen.

In acute leukæmia there is increase of leucocytes and eosinophile cells. Microorganisms in great number in blood and enlarged organs. Hintze (*Deutsches Archiv f. klin. Med.*, B. 53, H. 3, 4, '95).

Special transparent polynuclear leucocytes also found, but in remarkably increased quantities, in case of leukæmia. Georgierski (*Bolnitchnaja gaz. Botkina*, No. 10, '95).

The blood picture of acute myelogenic leukæmia is as follows: (1) Anæmia, progressive and severe; (2) a large increase of white blood corpuscles; (3) a large proportion (25 to 96 per cent.) of the white cells made up of myelocytes, large mononuclear cells of the same size, and faintly granular large mononuclear cells (transitional cells); (4) eosinophiles, mast cells, and nucleated red blood corpuscles may be absent or present in varying quantities. Frank Billings and Capps (*Amer. Jour. Med. Sci.*, Sept., 1903).

The red cells are in all cases reduced, little in some, extremely in others. As a general rule, poikilocytosis, microcytosis, and macrocytosis exist in degree corresponding to the oligocythæmia. Erythroblasts are very common in even mild cases of leukæmia with little oligocythæmia; normoblasts are the most frequent form noted, but microblasts and macroblasts may appear in large numbers. All the erythrocytic alterations seen in pernicious anæmia may be seen in leukæmia. The quantity of nucleated red cells seems, in a measure, due to the mechanical conditions in the marrow, but the mere presence of them is not a leukæmic sign, being simply the result of erythro-

genetic overactivity attempting to compensate for the hæmolysis.

Chemical changes of leukæmic blood are such as could be explained by the excess of leucocytes and the decrease of red corpuscles. Freund and Obermayer (*Zeit. f. physiol. Chemie*, Mar. 24, '91).

Attention called especially to the presence of large numbers of nucleated red corpuscles, and to free nuclei of such. The latter seemed to have been extruded from the cell. Indistinct evidence of mitosis was also a common feature of these nucleated red cells. McWeeney (*Dublin Jour. Med. Science*, July 14, '94).

Attention called to the process of filamentary budding of erythroblasts through the endothelial wall as a factor in the formation of red blood-cells. Observations made on leukæmic spleen. John Guitéras (*Inter. Med. Mag.*, Dec., '95).

From the circulating blood the white corpuscles are deposited in the various tissues, and these collections constitute the most important secondary lesions of the disease. Probably mechanical deposition and emigration both play a rôle in the formation of the collections, and it is commonly believed that, once established, the collections can maintain by cellular division their own existence. The spleen is the organ most often affected. Tremendous numbers of the leukæmic cells are deposited in the spleen, causing most remarkable enlargement, as a result of which the capsule thickens and the fibrous trabeculæ hypertrophy; so that in the late stages the organ is very hard. The essential lymphocytic structures of the spleen take no part in the process of proliferation; on the contrary, they are very scarce. The enlargement of the spleen is further augmented by the exercise of its functions in connection with the hæmolysis constantly going on. It is clear that the spleen is only secondarily affected in myelogenous leukæmia, and the term "spleno-myelogenous" leukæ-

mia, while serving to emphasize the splenic symptom, is not correct pathologically.

There are only four cases recorded of myelogenous leukæmia, in which there has been a disappearance of the splenic tumor as well as of the myelocytes. These are the cases of McCrae, Senn, Plehn, and Kohn. The three cases reported by Brown, Bryant, and Crane as cured have been observed so recently that they must for the present be excluded. Simon and Campbell (*Medical News*, July 23, 1904).

The liver is usually very much enlarged, due chiefly to the deposition of the circulating leukæmic cells. It is hard, smooth, light in color, and presents an excess of iron-pigment. The leukæmic collections follow the vascular channels. The excess of free hæmoglobin, effected by the hæmolysis, imposes upon the liver an augmentation of its functions, which doubtless increases its enlargement. In a few cases signs of a return to foetal hæmogenesis have been seen in the liver.

The intestinal tract is often the seat of large leukæmic depositions; the essential lymph-nodes of the submucosa, however, undergo no abnormal proliferation. The collections not infrequently necrose and ulcerate, the destruction being probably due to a mixed infection from the tract.

The skin may be the seat of depositions, which may ulcerate. Some of the cases of cutaneous multiple sarcomata are of this nature.

The kidneys usually present some infiltrations, which follow the vascular channels. Of the other organs of the body the pancreas, adrenal and thyroid bodies, the heart, the lungs, the upper respiratory tract and mouth (where ulcerations may occur), and the brain may present infiltrations which are usually slight in degree. Depositions within

the lymph-glands are not uncommon in the mediastinum, in the retroperitoneal glands, and in the peripheral glands; pressure-effects are then frequently produced. Infiltrations into the spinal cord are very rare.

Hæmorrhages are quite frequent in myelogenous leukæmia. They may be in the skin as petechiæ, under the sera, from the mucosa, and into organs, especially the brain. The blood and tissues after death often contain the well-known Charcot-Leyden crystals; in rare instances they are present preformed in the blood.

Thromboses are not rare, most often in the veins. Fatty degenerations in the parenchymatous structures of the heart, liver, kidneys, pancreas, and in the alimentary epithelium are quite the rule. Hyaline changes are often seen in both varieties of muscle.

LYMPHATIC LEUKÆMIA. — By *lymphatic* or *lymphocytic leukæmia* we understand the form of the disease in which the lymphocytic glands, nodes, and structures undergo the hyperplasia. The lymphocytic structures comprise the lymph-glands and spleen, the lymph-nodes of the bone-marrow, the tonsils and submucous nodes of the intestine, the subcutaneous lymph-nodes, and the scattered lymph-strands seen in all tissues, especially in the lung, liver, and kidneys. Commonly the hyperplasia affects the lymph-glands and the spleen; in rare instances it affects most notably the nodes in the skin (dermic leukæmia), in the intestine (intestinal leukæmia), or in the bone-marrow (osseous leukæmia, or lymphæmia).

The essential lesions consist in an abnormal hyperplasia of the glands or nodes, with the production of an excess of lymphocytes. The glands are much enlarged, soft in the early stages, but

later hard from trabecular and capsular fibrosis. Hæmorrhages may occur into them. The spleen is usually moderately enlarged, and, as the changes in it are active, the term "spleno-lymphatic" is pathologically correct. A case of lymphatic leukæmia affecting primarily the spleen alone has never been demonstrated. The inguinal, axillary, subclavicular, and cervical glands are the peripheral sites most often affected. The retroperitoneal and mediastinal glands may be enormously enlarged. In the intestinal type the submucous follicles are much enlarged. In the dermic form small lymph-nodes form multiple tumors beneath the skin. In both of these ulcerations may occur. In the osseous type the marrow presents pale areas resembling lymph-glands to the naked eye. Microscopically all these structures display active proliferation. The cells are polymorphous in type, and degenerations are common. The myelocytes are not involved in the hyperplasia, but as in any severe anæmia the marrow may be splenified.

The blood presents a lymphæmia or lymphocytosis. The number of white cells is much less than in the myelogenous type, rarely over 150,000 per cubic millimetre. The excess of cells is composed of lymphocytes, large and small, polymorphous in appearance, many presenting degenerations. The polymorphonuclear leucocytes, the non-granulated large mononuclear leucocytes, the eosinophiles, and the basophiles are present in normal or even subnormal numbers. Nucleated red cells are rare. The alterations in the number and quality of the red cells are much less than in myelogenous leukæmia.

The underlying cause of lymphatic leukæmia is an increased proliferation of lymphocytes in the lymph nodes. It has always been a question how these

cells reach the blood-stream until it was shown that this takes place, to some extent at least, via the lymphatics. The writer examined the vessels and found aggregations of cells around as well as within the vessel-walls. He could not, however, decide whether these cells reached the blood-stream passively or by virtue of their own amoeboid motions. M. Mosse (*Zeitsch. f. klin. Med.*, vol. 1, Nos. 1 and 2, 1903).

The secondary lesions are less marked than in myelogenous leukæmia. The infiltrations are present in the liver, kidneys, pancreas, and to a small extent in the other tissues, but they do not produce the marked organic enlargements noted in the other variety. The pigmentary changes are less marked, corresponding to the lesser degree of hæmolysis. The fatty and other degenerations are likewise less marked,—as are the hæmorrhages.

MIXED LEUKÆMIA.—By *mixed leukæmia* we understand the extensions of the hyperplasia to both the myelogenous and lymphocytic structures, and it has been well defined as an “autochthonous hyperplasia of the lymphatic tissues of the entire body,” both lymphocytic and leucocytic. The hyperplasia is more marked in the lymphocytic than in the myelogenous structures. Nearly all the cases are acute in form.

The lymph-glands are not markedly enlarged, they are soft and often have an hæmorrhagic tinge. Upon section the germ-centers are seen in a state of most remarkable proliferation: there are infiltrations into the vessel-walls and thus a direct flooding of the circulation with the mother-cells of the germ-nests, while the small lymphocytes reach the circulation by the usual channel. The same hyperplasia of the distorted germ-nests is seen in the intestinal (where ulcerations are common), in the osseous lymph-nodes, and in the tonsils. The

myelocytes are also engaged in abnormal proliferation, though less actively than are the lymphatic cells. Splenification of the marrow is not a marked condition.

The blood presents striking changes. The leucocytosis is not marked, rarely over 250,000 and often not over 50,000 per cubic millimetre. The larger majority of the cells are lymphocytes of large size, corresponding to the proliferating cells of the germ-nests. The lymphocytes are very polymorphous in appearance, and degenerations are commonly seen. The polymorphonuclear, eosinophilic, and basophilic cells are seldom increased, the polymorphonuclear cells are often decreased, and the eosinophiles may be almost absent. Myelocytes are not usually found in the circulating blood, despite the hyperplasia in the marrow. The red cells are more reduced than in chronic leukæmia. Nucleated red cells are not, however, a special feature. The qualitative changes in the red cells are marked.

The secondary depositions in the tissues are not marked. This is due to the acuteness of the process. Nevertheless, they exist in most of the organs and tissues. The spleen is proportionately not more enlarged than the lymph-glands; it is usually very soft. The depositions in the tissues correspond to the cells in the blood. Hæmorrhages are very common into the glands and organs, from the mucosa, into the skin and sera; they are present in three-fourths of the cases. Fatty degenerations are not so marked as in more chronic cases, but hyaline changes and areas of focal necrosis are common.

The digestion of most cases of leukæmia is chemically and physiologically defective. The salivary juice seems little affected. The gastric juice, however, is commonly deficient in HCl, pepsin, and

the curdling ferment. Motility is often reduced. The assimilation of food by such patients is usually notably below the normal.

The urine presents very important alterations. In most cases a marked increase in uric acid is found, often up to 2 to 3 grammes per diem. The alloxuric bodies are likewise somewhat increased. These conditions may produce stone. The performed and ethereal sulphates, the neutral sulphur, the phosphates, and calcium are eliminated in excess of the normal. Albumin is often present, usually not with casts. Acetone and diacetic acid may be present in periods of tissue-waste, while pathological urobilin and hæmatoporphyrinuria are usually demonstrable.

The tissue-changes in leukæmia are unusually active, the O input and CO₂ output are above the normal; there is, therefore, rather hyperoxidation than suboxidation. The parenchymatous degenerations are due to toxæmia.

In leukæmia in the cases where uric-acid excretion is normal or diminished, the alloxur bodies are increased, and their amount varies directly with the amount of leucocytes. Gumprecht (*Cent. f. allg. Path. u. path. Anat.*, vol. vii, p. 820, '96).

Influence of infectious diseases on leukæmia. On the occurrence of infectious disease in leukæmia it is often found that the specific tumors become smaller, and that the white corpuscles diminish in number: changes to be explained by the destructive action of the bacterial poison on the tissues. A qualitative change, due to the chemotactic action of the bacterial poison in the blood, may also take place; in this the lymphocytes take no part, but the polynuclear granulated cells increase, while the other granulated cells diminish. The chemotactic action of the bacterial poison is often, as in the case reported, more notable than the destructive. In this way it may happen in myelogenous leukæmia that, while the poly-

nuclear cells increase and the other granulated cells diminish in number, the gross total of white corpuscles remains the same. The influence of the bacterial poison upon the red corpuscles is not so important, and no notable alteration takes place save in certain severe cases in consequence of hæmorrhage, and it may be of hæmatocytolysis. Kõrmõezi (*Deut. med. Woch.*, No. 47, '99).

Treatment.—Rest, the best of care and hygienic surroundings, and a nutritious diet are the general indications. Arsenic is the best remedy, and should be given in ascending doses and for a long period of time. If it disturbs the stomach or provokes diarrhœa, it should be given hypodermically.

Bone-marrow has been used with some success, and, given with arsenic, it has seemed to heighten its action.

Case of splenic myelogenous leukæmia made worse by bone-marrow. C. E. Nam-mack (*Med. Rec.*, Jan. 4, '96).

Extract of spleen is of no value. Iron is of value in the periods of apparent convalescence, but has no influence on the leukæmic progress.

Case of splenic anæmia successfully treated internally with small doses of perchloride of mercury. E. Mondigliano (*La Pediatria*, Apr., '93).

Carbonic-acid gas administered to two cases of leucocythæmia. Oxygen was administered simultaneously and galvanism was applied to the region of the spleen for five minutes before, as well as during, the sitting. In both cases, one in a boy, the other in a young woman, there was perceptible diminution in the size of the spleen. Ewart (*Brit. Med. Jour.*, July 23, '98).

All treatment in acute leukæmia has thus far been useless. Every case has progressed to a fatal termination unmodified by the various forms of treatment employed. M. H. Fussell and A. E. Taylor (*Phila. Med. Jour.*, Jan. 7, '99).

Local treatment over the spleen or enlarged glands, — blisters, cauterization, the local applications of iodine, cold

douches, and electrical treatment may alleviate the symptoms to some extent. Excision of the spleen or of lymph-glands is contra-indicated both by theory and by unfortunate experience.

The various systemic disturbances—cough, anorexia, vomiting, diarrhœa, œdema, serous effusions, headache, insomnia, and neuralgia—demand appropriate treatment. In case of pressure upon large vascular trunks or nerve-trunks surgical interference may be indicated.

The treatment should be designed to place the patient under the most favorable hygienic conditions,—in a healthy, bracing climate on a dry soil, with good air, good food, and favorable surroundings,—and he should, if possible, be free from all sources of worry or mental emotion. The most valuable drug is arsenic, which should be commenced in small doses and gradually increased. All the above indications may probably be best fulfilled by sending the patient to undergo a course of arsenical waters at La Bourboule, in France (Department Puy-de-Dôme). Cold douches with the galvanic and faradic currents may possibly be useful. Quinine and iron are often employed, and oxygen inhalations may be tried, but are probably only resorted to in the later and more hopeless stages. The operation of splenectomy is hardly justified from the present pathological stand-point as a rational proceeding; but it has also against it the terrible objection that, out of 24 operations, only 1 patient has recovered. The chief danger seems to be that in leukæmic patients the blood has lost the power by which normal hæmostasis occurs, and the cut surfaces continue to bleed from vessels which offer nothing that the surgeon can tie. Transfusion appears to be useless. Ewart has recommended the inhalation of carbonic-acid gas, but no one has confirmed his favorable opinion of this treatment. The enlarged spleen may be supported by a bandage or belt, and the stomach troubles are relieved by the administra-

tion of small doses of dilute mineral acid after meals. Robert Saundby (Brit. Med. Jour., Jan. 5, 1901).

Under treatment with Roentgen rays some cases of leukæmia undergo marked change for the better. The leucocytes fall to normal numbers and sometimes show no more pathologic cells, the red blood-corpuscles improve, the enlarged spleen and lymphatic glands resume normal proportions, the general health seems restored. In some cases the effects are imperfect. In no case has observation been carried out long enough to speak of cure. In several cases death has occurred while the symptoms seemed to indicate improvement. The mode of action of the Roentgen rays is not known. George Dock (American Medicine, Dec. 24, 1904).

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LICORICE.—Licorice, or liquorice (glycyrrhiza, U. S. P.), is the root of *Glycyrrhiza glabra* (*Leguminosæ*), indigenous to Southern Europe, Syria, and Persia, and cultivated in several of the northern countries of Europe. The sweetest licorice comes from Italy. The root contains an amorphous, bitter-sweet glucoside, glycyrrhiza; a crystallizable principle, asparagin; resin, starch, albumin, liquin, lime and magnesium salts; and malic, phosphoric, and sulphuric acids. When glycyrrhiza is boiled with dilute acids it is resolved into sugar and a bitter brownish-yellow substance called glycyrrhetin. Glycyrrhiza treated with ammonia becomes ammoniated glycyrrhiza, which occurs in dark-brown or brownish-red, sweet scales, freely soluble in water or alcohol.

Preparations and Doses.—Glycyrrhiza (licorice-root), *ad libitum*.

Extractum glycyrrhizæ, 15 to 60 grains.

Trochisci ammonii chloridi, 1 to 2 troches.

Trochisci glycyrrhizæ et opii, 1 to 2 troches.

Extractum glycyrrhizæ fluidum, $\frac{1}{2}$ to 2 drachms.

Extractum glycyrrhizæ purum, $\frac{1}{2}$ to 2 drachms.

Mistura glycyrrhizæ composita, 2 to 6 drachms.

Glycyrrhizinum ammoniatum, 5 to 15 grains.

Pulvis glycyrrhizæ compositus, $\frac{1}{2}$ to 4 drachms.

Therapeutics.—The preparations of licorice are mostly used in affections of the air-passages and of the alimentary tract.

DISEASES OF THE RESPIRATORY TRACT.—In bronchial catarrh a popular remedy is the compound mixture of licorice, or brown mixture, which contains 3 parts of pure extract of licorice, 12 parts of paregoric, 6 parts of wine of antimony, and 3 parts each of sweet spirit of nitre, gum arabic, and sugar, and 70 parts of water.

In the various forms of pharyngitis and laryngitis, with irritable cough, the troches of licorice and opium (Wistar's cough-lozenges, containing 2 grains of extract of licorice and $\frac{1}{20}$ grain of extract of opium, with anise-oil, gum, and sugar) are useful in allaying the irritability and the cough. The troches of ammonium chloride are similarly used in pharyngitis, laryngitis, and subacute bronchitis.

CONSTIPATION.—In the compound powder of licorice we have a valuable remedy for constipation. It contains 18 parts of senna, 16 parts of licorice, 8 parts of fennel, 8 parts of washed sulphur, and 50 parts of sugar. It is largely used as a laxative during pregnancy and after childbirth, and may be given to children, on account of its pleasant taste.

PHARMACEUTICAL USES.—Ammoni-

ated glycyrrhiza is a useful agent to mask the bitter taste of quinine, being used in the proportion of two to one. The extract is used to conceal the taste of unpleasant remedies and to increase the cohesiveness of pills.

Powdered licorice-root is used to prevent pills from adhering to each other, and as a dusting-powder in pharmaceutical manipulations.

LIDS. See PALPEBRÆ.

LIME. See CALCIUM.

LINUM.—Linum (linseed or flaxseed) is the dried ripe seed of *Linum usitatissimum*, the common flax: a plant of almost universal cultivation. The seeds are oval and flattened, and have sharp edges and somewhat pointed extremities. Externally they are brown and shining; internally they are yellowish white. They have no odor, but a mucilaginous taste. They contain a fixed oil, wax, resin, extractive, tannin, gum, mucilage, albumin, gluten, and salts. The fixed oil is found in the interior of the seed, and when expressed without the aid of heat is known as linseed-oil (oleum lini, U. S. P.). When ground, the seeds form a grayish meal, known as flaxseed-meal, ground linseed, or linseed-meal. When freely ground the meal is rich in oil and free from rancidity. The cake of linseed which remains after the oil is expressed is known as oil-cake, and when ground is known as cake-meal, which is not only poor in oil, but liable to be rancid. Cake-meal is unfit for use in medicine.

Preparations and Doses.—Linum (flaxseed).

Oleum lini (linseed-oil), $\frac{1}{8}$ to 8 drachms.

Linimentum calcis (carron-oil).

Therapeutics.—On account of its demulcent action upon mucous membranes, flaxseed is used in the treatment of bron-

chitis, gastritis, acute cystitis, and nephritis. It is usually given in the form of flaxseed-tea:—

Whole flaxseed, 3 drachms.

Extract of licorice, 30 grains.

Boiling water, 10 ounces.

Mix and stand in a warm place for three or four hours, and add a little lemon-juice, lemon-peel, and sugar to taste, and 1 to 2 drachms of gum arabic. If cough is present add some paregoric.

Ground flaxseed mixed with boiling water forms the well-known flaxseed poultice. It should be spread at least half an inch in thickness upon muslin or flannel, the surface covered with gauze or cheese-cloth, and applied as hot as can be borne. It should be covered with thin rubber cloth to retain the heat and moisture and be renewed as soon as it *begins* to cool or dry. If counter-irritant effect is desired, the surface may be sprinkled with dry mustard or a few drops of turpentine. These applications are useful in pneumonia or pleurisy (as jacket-poultice), peritonitis, abscess, boils, felon, inflamed glands, indolent ulcers, etc. Laudanum is a valuable addition to a poultice in painful affections.

Carron-oil (linimentum calcis) is an old and efficient application to exclude air from burns. The addition of 1 drachm of carbolic acid to the pint of carron-oil increased its efficiency and adds antiseptic action. Linseed-oil, given in doses of 1 to 2 ounces, is a laxative of especial value when hæmorrhoids are present; it has been used as a nutrient by Sherwell, of Brooklyn, in various cachectic conditions.

LIPOMA. See TUMORS.

LIPS. See MOUTH AND LIPS.

LITHIUM.—Lithium is one of the alkali-metals, and is generally derived

from lipidolite, a native silicate. It is also found in petalite, spodumene, triphylite, and a few other minerals, and occurs in minute quantities in some mineral springs (Buffalo, Farmville [Va.], and Londonderry [N. H.] lithia-waters). The metal is not used in medicine. Like other alkali-metals, it unites with oxygen, forming an oxide, which with the acids forms salts, and also directly chlorine and bromine, etc. Lithium carbonate occurs as a light, white powder with distinct alkaline reaction, and is soluble in 130 parts of water and in dilute acids. Lithium citrate occurs as a white, crystalline powder, with feeble alkaline taste and almost neutral reaction. It is soluble in $5\frac{1}{2}$ parts of water and slightly soluble in alcohol. Lithium benzoate occurs as a light white powder or in shining sweet scales, and is soluble in 4 parts of water and 12 parts of alcohol. Lithium bromide occurs in white deliquescent, slightly-bitter granules, and is soluble in water and alcohol. Lithium salicylate occurs as a white deliquescent sweetish powder, is soluble in water and alcohol, and is decomposed by heat.

Preparations and Doses.

1. Carbonate (lithii carbonas), 3 to 15 grains.

Citrate (lithii citras), 10 to 30 grains.

Effervescent citrate (lithii citras effervescens), 1 to 2 drachms.

2. Benzoate (lithii benzoas), 10 to 30 grains.

Bromide (lithii bromidum), 5 to 40 grains.

Salicylate (lithii salicylas), 10 to 30 grains.

[The preparations in the first group act as lithium; those of the second group have the action of the acid or element forming them.]

Physiological Action.—Binet has shown that lithium salts give rise in animals to the following series of symptoms: Weakness, diarrhœa, nausea, dyspnœa, fall of temperature, convulsions, and death. The latter is attributed to depression and final arrest of the heart in diastole, coupled with an inhibitory influence upon the respiratory centres. The peripheral nervous system is paralyzed and muscular excitability is reduced.

The lithium salts probably have an important influence upon metabolism. They are promptly absorbed and eliminated with the urine, which is rendered alkaline. They have been shown capable of dissolving uric acid and the urates, and are therefore extensively used to counteract the so-called uric-acid diathesis.

Lithium is excreted in the saliva, into the stomach and bowel, and in the urine. The greater amount is excreted in the urine, though more appears in the stomach and bowel when nausea, vomiting, and diarrhœa have been profuse. It can usually be demonstrated in the secretions within ten minutes after a hypodermic injection, though its excretion proceeds slowly, for the writer has found it in secretions twenty-three days after the injections were stopped.

Lithium salts given to animals, hypodermically or by the stomach, cause, sooner or later, fatal gastro-enteritis. This gastro-enteritis is, undoubtedly, connected with the excretion of the metal through the bowel-wall. These salts do not possess any diuretic action that cannot be accounted for by their salt action. They render the urine alkaline, and thus act like the other alkalies. Lithium carbonate, in 15- to 20-grain (1 to 1 $\frac{1}{3}$ grammes) doses, and lithia tablets have been known to cause gastro-intestinal symptoms in man. Dilute solutions of lithium salts are not solvents for uric acid or urates. Clarence A. Good (*Amer. Jour. Med. Sciences*, Feb., 1903).

Therapeutics.—The preparations of lithium have held a high reputation for

efficiency in the treatment of the uric-acid diathesis in its many phases. It has been claimed that they can dissolve uric-acid calculi in the urinary passages or in the bladder. Haig has called our attention, however, to the fact that, although lithia forms salts with uric acid in the test-tube, in the body it has a greater affinity for the acid sodium phosphate in the blood, and thus the uric acid is left uncombined.

RHEUMATISM AND GOUT.—The carbonate, citrate, and salicylate are used in the treatment of rheumatoid arthritis, gout, and subacute and chronic rheumatism. The carbonate is practically insoluble in water (1 to 130), and should be given in freshly-made pill or capsules. Citrate may be given in solution alone in Vichy water or combined with other remedies. Lithium citrate, 1 $\frac{1}{2}$ drachms dissolved in 2 ounces each of spirit of Mindererus and syrup of lemon, may be given in dessertspoonful doses every two or three hours in rheumatism or gout. Lithium salicylate is especially useful in subacute rheumatism, given in doses of 10 to 20 grains every three hours.

CYSTITIS AND GRAVEL.—The lithia-salts are given in cystitis and gravel with great benefit. When there is an increased secretion of ropy mucus and the presence of alkaline urine, lithium benzoate is to be preferred, since it renders the urine more acid; when the urine is already too acid the carbonate or citrate is better.

DIABETES.—In diabetes, with gouty taint, the use of lithium carbonate or citrate in dose of 10 grains, combined with $\frac{1}{30}$ grain of sodium arsenite given three times daily, is often followed by remarkable results. (Hare.)

Lithium bromide is employed for the effect of the bromine it contains. It may succeed in epilepsy after the failure of

the potassium or sodium bromides. Its hypnotic power is regarded by Weir Mitchell as superior to that of potassium bromide.

LITHOLAPAXY. See URINARY SYSTEM, SURGICAL DISEASES OF.

LIVER AND GALL-BLADDER, DISEASES OF THE.

Diseases of the Liver.

Malformations.—Abnormalities in the form of the liver are not common. They may be either acquired or congenital.

1. Corset-liver.—The constant pressure of the lower ribs against the liver as a result of tight lacing or the wearing of a tight waist-band may produce a deep, transverse furrow on the right lobe from atrophy of the parenchyma. The furrow usually corresponds to the margin of the ribs, and may be so deep that the liver becomes divided into a large upper and a small, lower, part connected together by a narrow isthmus or band composed chiefly of fibrous tissue, the larger blood-vessels, and bile-ducts. The peritoneum in the groove is much thickened. The lower portion is usually rounded and may be freely movable as if hinged to the upper, and appear in the abdomen as a movable tumor.

This deformity is met with usually in elderly females. There are usually no symptoms resulting from the deformity; yet in some there is said to be a constant sensation of pressure and weight in the hepatic region. In occasional cases, in consequence of venous stasis, there is a temporary swelling of the isolated portion and violent pain and signs of irritation of the peritoneum.

2. Tongue-like Lobes.—These are probably of much more frequent occurrence, and therefore of much more importance, than the corset-liver. They are both of importance chiefly on account

of the difficulties they present in diagnosis. Riedel met with twelve cases of tongue-like lobes in forty-two operations for gall-stones. I have met with nine in various conditions. In two the mass was thought to be a movable kidney, and in one, an infant with hæmorrhagic pancreatitis, it was thought that possibly the tongue-like lobe was an intussusception. They are met with at all ages, and are probably usually congenital rather than acquired from external pressure. The diagnosis of these malformations is usually easy if the abdominal wall is thin and lax, as the connection of the mass with the liver can be definitely traced; but if the abdominal wall is thick from the deposit of fat or its muscles tense it is often impossible to differentiate these from other masses met with in the abdomen. An effort should be made to outline the mass and trace its connection to the liver. This is often impossible, as the base may be deeply furrowed and a loop of intestine may occupy the groove.

Treatment for these abnormalities is rarely called for. When the mass is troublesome from its mobility, and is not retained by a suitable bandage, it may be removed. Such has been done successfully.

The chief interest in this subject is in connection with the diagnosis of abdominal tumors. Unless fully alive to the great variety, as to shape and position, in which these accessory lobes of the liver may present themselves, one will often be misled in the diagnosis of abdominal tumors. In not a few cases, even with the utmost care, a positive opinion as to the nature of these tumors cannot be given.

Riedel, who first drew attention to the importance of these abnormal lobes, believes them to be due usually to press-

ure on the liver, as in tight lacing, and to traction, by an enlarged gall-bladder. They are met with usually in women. In nine of his twelve cases the gall-bladder was attached to the lower part of the process.

So far as can be inferred from the nine cases which I have met, tight lacing has little to do with the production of the deformity, and the position of the gall-bladder at the lower part of the mass is an accident rather than a cause of its formation. In many, if not almost all, cases the formation of these lobes seems to be developmental, having nothing to do with either pressure or traction.

Displacements.

Displacements of the liver may be either congenital or acquired. As instances of the former are hernia of the liver through the diaphragm and through the anterior abdominal wall. Interesting examples are also afforded by transposition of viscera, the liver being found to the left and the spleen to the right. As a rule, the other organs, both of the thorax and abdomen, are also transposed, the cardiac impulse being in the fourth or fifth intercostal space to the right; but the liver and spleen may be the only organs abnormally placed.

Symptoms.—There may be none, the condition being discovered accidentally. On the other hand, they may be severe, consisting of pain, tension, and dragging sensation in the normal hepatic region. Jaundice, sometimes severe, has been present in a few cases, probably due to tension or kinking of the common bile-duct. Hypochondriasis is apt to develop. The diagnosis may be difficult. Other masses—as carcinoma of the omentum, tumors of the right kidney, etc.—have been supposed to be movable liver. Of the greatest diagnostic importance are the form of the tumor, its mobility, the

possibility of reducing it to its normal position, the tympanitic note obtainable over the normal hepatic region before such reduction, and the dull note later.

Case in which diagnosis of tumor of large intestine, with atrophic cirrhosis, was made. Laparotomy showed liver entirely prolapsed and suspensory ligament entirely destroyed. Convex surface freshened and sutured in contact with parietal peritoneum. Two years and nine months later patient seen. Liver fixed to abdominal wall by extensive adhesions. Lanelongue and Faguet (*La Sem. Méd.*, Aug. 7, '95).

In a diagnosis of floating liver percussion is of some value in determining displacements, but palpation is much more important if done by using the palmar surface of the fingers of the entire hand to exert strong pressure. This should begin at the right border of the ribs, where a portion of the liver-surface is always found. From this point it should pass downward and forward, as far as the umbilicus. Sometimes the lower border can be recognized as low as the umbilicus, and in these cases it is often possible to palpate the convex superior surface by inserting the fingers deeply between the liver and the right costal arch. The recumbent and upright position should both be used, as in cases of highly developed mobility of the liver the organ may slip back into its normal position as the patient lies down. Max Einhorn (*Med. Record*, Sept. 16, '99).

Etiology.—Acquired displacements may be due to pressure upward by ascitic effusion, abdominal tumors, and flatulent distension, and downward by thoracic or subdiaphragmatic accumulations. These are, however, scarcely entitled to be included among liver-displacements. The movable or wandering liver is of more interest. The condition is not very rare.

Graham, in the *Transactions of the Association of American Physicians*, volume x, has tabulated sixty-six cases, all

of which have been reported during the last thirty years. It is found chiefly in females who have borne several children. The displacement is favored by a lax abdomen, tight lacing of the lower part of the chest, and sudden muscular strain. To render these causes effective it is probably necessary that the ligaments supporting the liver be abnormally long or weak: a condition that is doubtless congenital.

Treatment.—Treatment is not very satisfactory. A suitable bandage may relieve symptoms. The liver cannot be retained in the normal position by it, but further prolapse may be prevented and the liver so far supported as to relieve the pain and dragging. In a few cases the liver has been successfully sutured in position.

Case of fixation of movable liver. A Lagenbuch incision was made. The serous coat of the liver and corresponding surface on the parietes behind the costal cartilages were scratched with the knife so that adhesive exudation might be encouraged. Three No. 3 silks were passed to the depth of half an inch into the substance of the liver, and brought out between the cartilages of the false ribs; finally they were tied. Three more silks were employed to fix the liver to the upper part of the incision; they included peritoneum and muscle. A year and ten months later the patient was in good health. Blanc (*Loire Méd.*, Dec. 15. '97).

The treatment of floating liver resembles, on the whole, that of enteroptosis, and especially that of floating kidney. Here, also, the chief measure is the application of well-fitting abdominal bandages, which support the lower half of the abdomen in an upward direction, and increase the tension of the abdominal walls. A special pad for pressing the liver still farther back is of as little service here as in floating kidney. General massage and hydrotherapeutic measures, which have for their aim the strengthening of the organism, are of high value. In the front rank of all

these methods is an appropriate diet. The patient should be directed to take as much food as other healthy persons, and a little more. If besides the ordinary diet an additional quarter of a pound of butter is ordered daily, much will be accomplished by this means alone, and most of the patients will show an increase in weight. Gymnastic exercises in the open air, and, in cases with a tendency to constipation, special exercises for the abdominal muscles, are likewise of value. Operative procedures are personally opposed. Max Einhorn (*Clin. Jour.*, Oct. 4, '99).

Literature contains 98 cases of movable liver. An injury, a severe fall, or heavy lifting, or, in a few instances, the development of a malignant growth in the liver, is the usual cause. The prominent symptoms are distress and feeling of weight in the region of the liver, often considerable tympanites and intestinal indigestion, alternating constipation and diarrhœa, and marked nervous symptoms (headaches, restlessness, hypochondriasis, etc.). Tight bandaging with proper tonic treatment usually affords relief. Few attempts at operative interference have been made. J. H. Carstens (*Jour. Amer. Med. Assoc.*, May 17, 1902).

Congestion of the Liver.

This pathological condition does not constitute a disease of itself, but is always associated with disease elsewhere, especially of the gastro-intestinal tract and the heart. The liver is particularly prone to disturbance of its circulation, because, in the first place, of its large blood-supply and, in the second place, on account of its relationship to the gastro-intestinal tract on the one side and to the heart on the other. As the bulk of its blood-supply is conveyed to it by the portal vein, it will share in all the congestive disturbances of the organs drained by the portal system. The increased *inflow* of blood resulting from these disturbances constitutes an active congestion of the liver. On the other

side its proximity to the heart, and the absence of valvular structures between it and the heart render it very susceptible to any obstruction at the tricuspid orifice. Such conditions offer an impediment to the *outflow* of blood from the hepatic veins, and results in passive congestion of the liver.

Active Congestion.

SYMPTOMS.—They are those of gastro-intestinal catarrh, such as headache, malaise, foul taste, coated tongue, constipation, etc. With these may be present a sense of discomfort, weight, or even pain in the region of the liver, which may also be tender on pressure. The liver may be felt below the costal margin. There may be slight jaundice; in the severe tonic cases the jaundice may be intense.

The urine is dark, of high specific gravity, somewhat scanty, and loaded with urates.

DIAGNOSIS.—The diagnosis is based on the association of the symptoms of gastro-intestinal disturbance, with the enlargement of the liver, with the discomfort in the hepatic region.

ETIOLOGY.—There are two main groups of causes: (1) gastro-intestinal and (2) toxic. The most common of the first are catarrhal conditions of the stomach and intestines resulting from undue indulgence in food, and drink, especially if of a stimulating nature, as spices and alcohol. The habitual use of spirits to excess furnishes the most marked examples in these northern climates. Persons of sedentary habits are more liable to be affected, especially at middle age. Toxic causes occur in infectious diseases, especially in malaria, dysentery, typhoid fever, yellow fever, etc. Even these causes act chiefly through the gastro-intestinal tract. They are much more common in tropical climates.

Active congestion of the liver is also met with in suppressed menstruation and in diabetes mellitus. In both of these it has been attributed to vasomotor disturbance, but in diabetes the increased work thrown on the liver may be the chief cause.

MORBID ANATOMY.—The liver is enlarged, dark in color and the vessels full of blood. The distension of the lobule with blood is not limited to the centre, but is general. There is often some fatty change in the liver-cells.

TREATMENT.—The indications are chiefly two: (1) to correct the habits that have mainly caused the condition and (2) to relieve the gastro-intestinal conditions and the hyperæmia of the liver. We aim at attaining both objects simultaneously. The diet should be of the blandest nature. In severe cases no food should be given until the bowels are acted on and the portal system depleted by a brisk laxative. Water should be taken freely on an empty stomach. The food should be regulated according to the needs of each case so as not to tax the digestive powers. Exercise should be free, but without undue fatigue.

Three cases of severe pain in the hypochondrium, radiating to the shoulder, in which the diagnosis lay between acute hepatitis and abscess. After disinfection of the skin the large needle of Potain's aspirator was introduced at the point of greatest pain or greatest tumefaction. Several punctures in different directions gave only blood, and this was allowed to flow till two or three ounces had been abstracted. The wound was then closed with iodoform gauze and collodion. There was no after-hæmorrhage. From the next day the patient was greatly relieved, the liver decreased in size, and the patient was cured. Personally considered as a simple and innocuous procedure. Bemlinger (Brit. Med. Jour., Feb. 2, 1901).

Passive Congestion of the Liver.

DEFINITION.—Passive congestion of the liver (nutmeg liver, cardiac liver, red or cyanotic atrophy of the liver), is a pathological condition caused by obstruction to the outflow of hepatic blood.

SYMPTOMS.—The symptoms are chiefly those of the condition of the heart and lungs causing the hepatic congestion. There may be a sense of weight and fullness in the right hypochondrium, aggravated by external pressure, deep inspiration, and by lying on the left side.

Enlargement of the liver is one of the chief signs and is usually best demonstrated by palpation. When large, the liver can often be delimited by inspection. Percussion is usually unreliable on account of distension of the intestines.

Pulsation of the liver is often present in severe cases; it disappears when the induration develops and the heart becomes weak. I have seen it persist in cases of initial stenosis until within a few weeks of death.

Gastro-intestinal symptoms are always present. They result from the portal congestion induced by the hepatic obstruction. They consist in disturbed digestion, and, often, hæmorrhoids.

Ascites is frequent. In the early stage it occurs as a part of general dropsy. Later, when the liver becomes indurated it is increased by the portal obstruction. Jaundice is usually present, and is a definite symptom in the advanced cases. It is probably secondary to the gastro-duodenal catarrh. It is usually most marked in the cardiac cases, and, with the cyanosis existing in such cases, it causes a peculiar dusky green tint.

ETIOLOGY.—The causes leading to this condition are such as lead to interference with the free flow of blood through the heart, and include, therefore, all changes in the heart and lungs which

tend to render the right ventricle incompetent. Of the cardiac conditions the most common is mitral disease, especially stenosis; but all heart-lesions, whether of the valves or of the substance of the heart, tend to impede the venous flow by ultimately overtaking the right heart. Such diseases of the lungs as emphysema, asthma, chronic bronchitis, etc., are also frequent causes of dilatation of the right heart, and thus lead to obstruction to the hepatic outflow.

Deformity of the spine, pleuritic effusion, aneurism, and intrathoracic tumors may obstruct the flow of blood through the heart and lungs or press upon the vena cava directly.

Occasionally a local lesion, as peri-hepatitis, may compress the hepatic veins themselves or the vena cava and obstruct the outflow from the liver.

The liver examined in 35 cases of advanced central red atrophy. The writer finds constantly in this condition thrombosis of the capillaries toward the central portion of the liver lobule. The capillary plugs are to be seen as soon as the degeneration of the liver cells makes its appearance, and the extent of the thrombosis is in direct proportion to the degeneration of the liver cells. The production of the thrombi forms a new argument in favor of Schmidt's theory concerning the relationship between fibrin coagulation and cell degeneration. Hart (*Ziegler's Beiträge*, Bd. xxxv, p. 303, 1904).

MORBID ANATOMY.—In the early stage there is great engorgement of the hepatic veins and their intralobular branches and capillaries. The liver may become much enlarged, its lower border extending in time to, or even below, the umbilicus. If the obstruction be removed before organic changes have occurred in the liver, the vessels rapidly empty themselves, and the liver returns to its normal size. Even after long-continued congestion the liver may be much smaller

after death, unless escape of the blood from the hepatic veins is prevented by distension of the right ventricle.

Persistent hyperæmia leads in time to structural changes. As the intra-lobular veins are greatly dilated, the liver-cells around them atrophy from pressure, and blood-pigment is deposited. The centre of the lobule becomes dark, contrasting strongly with the periphery, which becomes yellowish, on account of fatty degeneration of its cells; hence the "nutmeg" appearance of the section.

In course of time atrophy of the liver-cells is succeeded by increase of connective tissue. Induration and shrinking result, and may lead to considerable reduction in the size of the liver.

TREATMENT.—The treatment is chiefly that of the condition of the heart or lungs that causes it, at the same time endeavoring to relieve portal congestion. The latter is usually effected by the action of cathartics. A more rapid effect may be obtained by local depletion with leeches, five or six being applied over the liver. Their application is usually attended by marked relief when there is pain and distress in this region.

Calomel, in repeated doses, is not only an active cathartic, but also an efficient diuretic in such cases. Digitalis may be combined with it to increase the power of the heart and secure greater diuretic effect. The condition of the heart requires the administration of heart-tonics, as digitalis, strychnine, etc. Vegetable cathartics — as podophyllin, colocynth, jalap, aloes, etc.—may be used, or salines, such as sulphate of soda, sulphate of magnesia, or the natural purgative waters (such as Apenta or Hunyadi, Rubinat, Hawthorn, Friedrichshall), etc.

Perihepatitis.

This consists in an inflammation of the peritoneal capsule of the liver. In-

flammation of the fibrous capsule apart from the peritoneal occurs only as secondary to interstitial hepatitis.

Inflammation of the peritoneal covering of the liver may occur either as a part of general peritonitis or as a local disease. It may be acute or chronic, the former being usually suppurative while the latter is always fibrinous or adhesive.

Acute Perihepatitis; Subphrenic Abscess; Pyopneumoperihepatitis.

SYMPTOMS.—The development of the disease may be with striking symptoms suggestive of perforative peritonitis of the upper part of the abdomen, or it may be so insidious as not to attract attention until the abscess has attained a large size.

Pain in the right hypochondrium or epigastrium is the most prominent symptom. It is increased by pressure and movement; hence the respiration is shallow and costal. Fever, often ushered in by a chill, is present; it may be quite remittent. There may also be abdominal distension, vomiting, hic-cough, slight jaundice, weak pulse, etc.

The physical signs presented will depend largely on the size of the abscess. In the beginning there may be a friction-rub. If the abscess is large there is presented great fullness in the right hypochondrium, with extension upward of hepatic dullness, even to the angle of the scapula, and of the edge of liver downward, it may be, to the umbilicus. The upper limit of dullness is convex toward the thorax, following the curve of the diaphragm. Over this area there is absence of all respiratory signs. The course of acute perihepatitis, in the absence of suppuration, may be rapid, recovery taking place in a few days; in suppurative cases it may be prolonged for months with all the symptoms of chronic suppuration, as irregular tem-

perature, sweats, loss of flesh, etc. In many cases fistulous openings take place through the diaphragm, causing a localized empyema, which, in time, perforates the lung into a bronchus, with abundant purulent expectoration, or externally through an intercostal space. In others the abscess discharges into the stomach or intestine. The general course of subphrenic abscess resembles that of empyema or abscess of the liver. The result is usually fatal, unless efficient drainage be established. Of all the cases recorded only about twenty have recovered.

DIAGNOSIS.—In subphrenic abscess the signs are so indefinite that a diagnosis is only exceptionally made. The abscess is usually mistaken for empyema. A history of disease of the stomach, duodenum, or gall-bladder would indicate a perihepatitis, as would also a history of abscess from appendicitis. The absence of a history of intrathoracic symptoms—such as cough, expectoration, etc.—renders pleuritic disease improbable.

The physical signs are those of massive enlargement of the liver; if the abscess-cavity contains air, the signs of movable dullness and tympany of pneumothorax are added. However, the bulging of the right side is greatest below the diaphragm rather than above. The diaphragm may be pressed upward to the third, or even the second rib, but, however high it is, its limits are well defined and above it the respiratory sounds are not obscured. The lower border of the liver may be greatly depressed. The heart is not much displaced, as it is in pleural effusion.

On exploratory puncture, if the pus is reached, the spurting is most forcible on inspiration, owing to the descent of the diaphragm. This would practically be

conclusive evidence of the seat of the abscess. The presence of bile-pigment in the pus would also indicate that the abscess is below the diaphragm.

This may occur in one of five ways: As a localized abscess, a part of general purulent peritonitis; by extension of the diseased process from the appendix to the subphrenic region by an intraperitoneal route; by extension of the diseased process by an extraperitoneal route, either by way of the lymphatics or by infiltration through the retroperitoneal tissue; by way of the blood-current as part of a general embolic septic process; or as a sequence of liver-abscesses which are of embolic origin by way of the portal vein. H. A. Christian and L. C. Lehr (*Medical News*, Jan. 24, 1903).

ETIOLOGY.—It occurs occasionally from a blow or direct injury. It is usually secondary to disease in some adjacent part or of the liver itself, such as perforating ulcer of the stomach or duodenum, perforation of the gall-bladder, perforation of the intestine or the appendix; abscess of, or in the region of, the kidney, spleen, or appendix; suppuration in the right pleura, the pyogenic organisms making their way through the diaphragm by the lymphatics; abscess of the liver, echinococcus cyst of the liver, suppurative cholangitis, etc.

MORBID ANATOMY.—In the early stage the peritoneum of the liver and of the corresponding part of the diaphragm presents the signs of inflammation. The inflammation at the margins of the affected area being less severe, adhesion of the opposing surfaces takes place, while the exudate in the central part, being rich in leucocytes, liquefies, and an abscess results. The abscess may be small or so large as to contain a quart or more of pus. The pus may be creamy and odorless, but more often it is foetid and contains necrotic tissue.

It may be dark red from admixture of blood or green from bile. Occasionally air or gas is present, even when no communication with a bronchus or with the stomach or bowel can be found. These abscesses are found usually between the right lobe of the liver and the diaphragm, but may be over the left lobe.

Study of 28 cases of suppurative hepatitis admitted to the Presbyterian Hospital, New York, the past twenty years. The infection reached the liver by way of the portal vein in 17 cases; by way of the hepatic artery in 3 cases; by way of the bile-passages in 3 cases; unknown in 6 cases.

Of the first 17 cases, lesions of the alimentary tract were found in 10 cases post-mortem, while the other 7 showed evidence of intestinal lesions. In not a single case were amœbæ coli found in the stools or hepatic abscess. A general pyæmic process attended the portal-vein cases, 2 of them being secondary to malignant endocarditis and the third following puerperal sepsis.

In the 3 cases due to occlusion of the biliary passages, the common duct was occluded in 2 cases by a calculus. The 28 cases had fever of an irregular type with chills. Icterus was present in only 6 cases. Pain and tenderness over the hepatic region were usually present, Stuart Hart (Presbyterian Hosp. Reports, vol. iv, p. 150, 1900).

TREATMENT.—In the early stages the aim of treatment should be to secure relief from pain and arrest of the inflammation. This is best effected by rest in bed, the application of five or six leeches over the seat of disease, and the hypodermic injection of morphine. Purging freely by salines may be of much benefit. Useful, but less effective, means than leeching are the local application of heat, poultices, sinapisms, or blisters. As soon as the formation of pus can be determined, free drainage should be resorted to. This may necessitate the resection of one or more ribs, but in any case the

drainage should be as complete as possible.

Case of subphrenic abscess which recovered after drainage through the abdominal wall. The case was complicated by an effusion of serum into the pleural cavity, which was removed by the aspirator on several occasions. Campbell and Wood (Brit. Med. Jour., March 23, 1901).

Chronic Perihepatitis.

This condition may be local or general. Local perihepatitis is always secondary. It is seen, for example, around the gall-bladder in some cases of gall-stones; over a tumor in the liver; at the point of adhesion to the liver of an ulcerated stomach or intestine; as the result of a local tuberculous or carcinomatous deposit; and in many cases of venous obstruction whether from cardiac or pulmonary disease. It may result also from pressure, as in the furrows produced by tight lacing or constriction of the liver from any cause.

General perihepatitis is a very different condition. Our knowledge of it is derived chiefly from the records of Guy's Hospital. In "Allbutt's System of Medicine," volume iv, Dr. W. Hale White gives a valuable account of the condition based on these records. In it "the whole capsule becomes thick, opaque, and white . . . easily peels off the subjacent liver, the surface of which is smooth; and for some unexplained reason it is quite common to find the inferior edge folded up on to the anterior surface of the liver." This thickened capsule is often pitted deeply. The liver is usually slightly atrophied, but otherwise little altered. The thickened capsule does not seem to cause pressure upon the vessels at the transverse fissure. The capsule of the spleen and the general peritoneum is usually also thickened. The omentum may be thickened

and contracted, forming a tumor across the abdomen.

Of the 22 cases analyzed by White in 19 there was chronic granular kidney, and he thinks the chronic peritonitis and general perihepatitis should be regarded as a sequel to the renal disease. Ascites, resulting probably from the chronic peritonitis, is nearly always abundant and requires repeated tapping. These cases are doubtless frequently looked upon as cirrhosis of the liver. Further study of the condition is much needed.

Acute Yellow Atrophy of the Liver (Malignant Jaundice).

Definition.—A grave form of jaundice characterized by extensive destruction of the liver-cells, with atrophy of the liver and clinically by grave constitutional disturbance in which the cerebral symptoms are especially prominent.

SYMPTOMS.—In the prodromal period there is no time to distinguish it from ordinary jaundice. The same symptoms usher in loss of appetite, malaise, nausea, and vomiting, jaundice following in a day or two. It differs from ordinary jaundice in the occurrence of some rise of temperature.

This stage may last from a few days to two or three weeks. The bowels are constipated and fæces pale; the urine contains bile-pigment. There may be pain in the hepatic region.

Suddenly a marked change occurs, characterized by severe headache, repeated vomiting, delirium, and restlessness. The vomited matters are at first bile-stained and later contain blood more or less altered, and the stools may also contain blood, making them dark and offensive. At the same time the jaundice deepens and becomes of a greenish hue. The temperature falls to normal, or usually below it; the pulse rises to 120 or more and becomes weak. Stupor

sets in and deepens into coma. There may be convulsions. In women menorrhagia may occur and, if pregnant, abortion or premature delivery take place.

Case of acute yellow atrophy in a woman who had passed through five normal labors and presented a high degree of jaundice during her sixth pregnancy. The liver-dullness extended over an area only two or three fingers' breadths in extent and the urine was covered with bile, but otherwise there was no abnormal signs or symptoms. The patient sank into a state of stupor, gave birth to a macerated foetus, and died two days later. H. Thompson (*Centralb. f. Gynäk.*, Nov. 12, '98).

The urine becomes deeply bile-stained and often contains tube-casts. It becomes lessened and may be suppressed. There is great diminution, or even absence, of urea, and its place usually is taken by abnormal constituents, especially by tyrosin and leucin.

A case of acute yellow atrophy following syphilitic infection. For the last fourteen days of life daily examinations were made of the urine to determine the amount of urea, ammonium, the alloxin bodies, and the uric acid excreted. The total quantity of nitrogen remained almost constant. The urea was perfectly normal in amount until the last two days, when, during the existence of severe coma, there was a moderate reduction. The ammonium was slightly increased, but hardly enough to be supposed to be the result of insufficiency of the hepatic cells and consequent imperfect formation of the urea. Richter (*Berl. klin. Woch.*, No. 21, '96).

The most characteristic physical sign in this stage is the rapid diminution, it may be disappearance, of the area of hepatic dullness; so that the hepatic area may become tympanitic. It is also frequently tender to pressure, even in the comatose state.

The stage lasts only two or three days and nearly always terminates fatally.

DIAGNOSIS.—It is not possible to dis-

tinguish acute yellow atrophy before the development of the grave symptoms. Then the symptom group is characteristic: intense jaundice; severe, persistent vomiting, rapid disappearance of hepatic dullness; delirium, passing rapidly into coma; leucin and tyrosin crystals in the urine.

Hypertrophic cirrhosis sometimes presents similar symptoms, but the long duration and the large liver serve to exclude this affection. In this the symptoms of icterus gravis may develop and the case present all the features of acute yellow atrophy.

Phosphorus poisoning closely resembles acute yellow atrophy, but the liver does not diminish so rapidly, if at all, the nervous symptoms are not so grave, leucin and tyrosin do not usually appear in the urine in phosphorus poisoning, and the gastric symptoms are usually more severe.

ETIOLOGY.—This disease is rare. Until 1894 Hunter found but 250 cases recorded, and since then (1895 to 1898, inclusive) I have found the reports of 29 cases. A few observers have, however, seen several cases within a few months, indicating an endemic agent, while others with large experience have not met a case. I met with one in 1890 in the Toronto General Hospital.

No age is exempt, from the infant of a few days to the octogenarian. It is most common between the ages of 20 and 30 years.

It is more common in females than males, especially between the ages of 20 and 40; that is, during the childbearing period. Pregnancy has a most important bearing on the causation, nearly half the cases met with in women occurring during pregnancy; especially the latter part of it. This is probably explained by the fact that some degenera-

tion of the cells of the liver and kidney is a common condition in pregnancy. Fear and mental emotion have apparently been the cause in a few cases.

Acute yellow atrophy of the liver during pregnancy is quite rare. From 1883 up to the present time, 37,475 labors and abortions were treated at the Government Maternity Hospital in Madras, and during that period but five cases of this disease have been noted. In 1886 two cases were recorded. The writer gave a case reported thyroid extract on the supposition that the disease was one due to perverted metabolism, but, of course, no results could be obtained, as the patient rapidly succumbed. A. J. Sturmer (*Brit. Jour. of Obstet.*, Dec., 1903).

Alcoholic excess has preceded the disease in several cases. The disease may be the result of various infections, such as typhoid, diphtheria, and septicæmia. The resemblances of the symptoms to those of phosphorus poisoning are undoubted, but there are essential differences in the resulting morbid changes that render it clear that the two conditions are not identical. In view of the variety of conditions under which the disease occurs, it is highly probable that it is due to various forms of infection.

MORBID ANATOMY.—The liver is greatly reduced in size; it may be less than half its normal weight. It is thin, flabby, and wrinkled in appearance.

On section it is tough rather than firm. The cut surface varies in color from a yellowish to a reddish brown and is often mottled irregularly. The lobules are small and indistinct; in the parts most advanced in degeneration they cannot be distinguished.

On microscopical examination the liver-cells are found greatly degenerated, containing swelled, indistinct nuclei and fat-granules. In many parts they have been entirely replaced by fat-granules

and *débris* held together by the liver-stroma.

Essential anatomical changes in yellow atrophy: a fatty degeneration and necrosis of liver-cells, produced by several different infections, of which syphilis may be one. E. Meder (*Beiträge zur path. Anat.*, etc., B. 16, p. 143, '95); Marchand (*Beiträge zur path. Anat.*, etc., B. 16, p. 206, '95); Huber (*La Presse Méd.*, June 19, '95).

Case of acute yellow atrophy of the liver in a boy of 4 years. At the autopsy there was cheesy degeneration of the lymph-glands at the root of the lung; enlarged spleen, and a small, firm, tough liver, filled with yellow areas and some small red points. Microscopically the cells showed indefinite contours, poorly-staining nuclei, and fatty degeneration. The central veins were greatly dilated and surrounded by a round-celled infiltration. Friederich Lanz (*Wien. klin. Woch.*, July 23, '97).

In less degenerated parts the periphery of the lobules is most affected where the cells are disintegrated and the biliary canaliculi distended with desquamated epithelium and granular masses of bile-pigment, constituting a complete obstruction to the flow of bile. In these parts active cell-division may be found, as if an effort were being made to regenerate the hepatic parenchyma. It is possibly due to this activity that recovery takes place in rare cases.

In acute yellow atrophy, the poison, whatever its nature may be, may affect the liver very unequally and in different degree. Thus, in the same liver there may be found areas in which the liver-cells have still their nuclei well preserved, others in which the cells are entirely necrosed, and others again in which the liver-cells have disappeared; in the last, if there has been sufficient time, proliferative changes are well marked. It is also quite possible that in certain cases the poison may act only locally, and that recovery may take place. Stroebe (*Ziegler's Beiträge*, vol. xvii, p. 206).

The larger bile-ducts are usually free

from bile, containing mucus only; the gall-bladder often contains a little bile.

Micro-organisms of various kinds have been found in some cases, but not with such constancy as to indicate that they take any active part in the causation of the disease.

These briefly were the conditions found by Prof. A. B. Macallum in a case of mine in 1890, and from them he concluded that the disease is caused by a toxic agent carried to the liver by the portal vein and, therefore, originating in the intestine (*Brit. Med. Jour.*, volume i, '94).

There is general bile-staining of other organs and tissues. Numerous hæmorrhages are found in various situations. The heart, voluntary muscles, and renal epithelium usually show fatty degeneration. The spleen is large and there may be considerable effusion into the pleural and pericardial cavities. There are evidences of catarrh in the digestive tract.

In acute yellow atrophy the cord may show changes which seem to be, like atrophy of the liver, the result of the severe general intoxication. Goldscheider and Moxter (*Fortschritte der Med.*, No. 14, '97).

PROGNOSIS.—The disease is so fatal that recovery almost implies a mistake in diagnosis.

The statistics of the Havana Civil Hospital show that acute yellow atrophy is by no means necessarily fatal, as there have been 11 recoveries, besides 1 which was returned as improved. Martinez (*Rev. de las Ciencias Med.*, p. 100, '89).

Case of favorable termination of acute yellow atrophy, it being the sixteenth on record. The patient was nourished for a month by rectal injection of peptone, eggs, and milk. Weising (*Schmidt's Jahrbucher*, Aug. 15, '92).

TREATMENT.—This is purely symptomatic. There are no remedies known to have any influence on the disease.

Treatment is never very effectual in acute yellow atrophy, but the main in-

dications are to be met at first by cathartics and later by tonics. Martinez (Rev. de las Ciencias Med., p. 100, '89).

Abscess of the Liver.

Symptoms.—The outset of the disease is always insidious and the course may be latent throughout, an unsuspected abscess being found at the autopsy. When not latent, the cardinal symptoms are: fever, with free perspiration, pain, enlargement of the liver, and signs of septic infection. There is loss of appetite, more or less rapid emaciation and increasing weakness and anæmia. There is a sense of weight and distress in the epigastric and right hypochondriac regions, with sometimes hiccough, nausea, and even vomiting. An icteroid hue develops, rarely, marked jaundice. The temperature is elevated from the first and is of a septic character. It is irregular, being normal at times, then rising to 103 or more, with a more or less marked chill, to defervesce again with profuse sweating. These variations may be so regular as to clearly simulate malarial fever, but the variations lose their regularity in a few days. In other cases typhoid fever is simulated. With the evacuation of the pus, the temperature may fall to normal and remain so; much will depend on the thickness of the abscess-wall and whether other foci of suppuration co-exist. The pulse-rate varies in general with the temperature, but toward the end of life it becomes greatly accelerated and feeble.

Pain is variable, and probably is not present until the abscess approaches the surface of the liver. It is usually referred to the scapular region, but may be felt in the region of the liver. The patient usually finds lying on the back or right side most comfortable; on the left side the liver drags on its ligaments and any inflammatory adhesions that may be formed and causes discom-

fort. Pressure at the costal margin, especially in the nipple-line, is usually painful.

Enlargement of the liver is most marked in the right lobe, and may be more apparent in the erect posture. In multiple abscesses and pylephlebitis the enlargement is general and rarely great. In tropical abscess when situated, as it usually is, in the dome of the liver, the enlargement is chiefly upward, contrasting with the downward enlargement usual in new growths of the liver. The area of thoracic dullness may be sharply convex upward and rise to the fifth rib in the midaxillary line and posteriorly to the angle of the scapula. It has been reported to even reach the second rib in front and the spine of the scapula behind. In these cases of extremely large abscess the right side is bulged and the lower margin of the liver depressed, it may be, to the iliac crest; over the liver there is tenderness and often crepitus to palpation; and occasionally fluctuation may be elicited.

Two cases of abscess of the liver in army-officers, aged 28 and 27 years, respectively. In each case dysentery had preceded the hepatic abscess, and the pus had made its exit through the bronchial tubes. The symptoms were extreme emaciation and anæmia, a constant cough with very free expectoration of pus, fever varying from 102° to 103.5° F., a good appetite, and no diarrhœa. Both made good recoveries. Ferron (*Jour. de Méd. de Bordeaux*, Apr. 23, '93).

No local pain in hepatic abscess, except in rare instances. Tschernow (*Wratsch*, Nos. 35, 39, '94).

The absence of rigors is more often a feature of chronic abscess than of acute. Dreschfeld (*Med. Chronicle*, June 1, '97).

Tropical abscess of the liver may run its entire course without giving any subjective symptoms that would attract the physician's attention to the liver.

Absorption-icterus is rare in tropical abscess. In the cases of abscess of portal

origin icterus is relatively more frequent. The involvement of the peritoneal covering of the liver causes severe pain on respiration.

Involvement of the phrenic nerve and the diaphragm is responsible for some of the most constant manifestations of hepatic abscess of amœbic origin. Pain may be referred to the shoulder-joint; scapular, clavicular, or deltoid region; or to the side of the neck, or may even extend down the inner aspect of the arm and forearm.

The pain may be sharp, lancinating, or dull, or simply a sense of tension or fullness in this region.

Tussis hepatica is due to phrenic irritation; it may occur with abscess or gallstones. Hiccough is produced through the agency of the phrenic nerve. The patient may suffer with dyspnœa. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Sept., '97).

Owing to the frequent situation of the abscess in the dome of the liver, implication of the lung is more frequent in the tropical, or amœbic, cases than in the septic ones occurring in our northern climates. The pulmonary symptoms often occur early and become so pronounced as to obscure the hepatic symptoms. They usually consist of stitch-like pain and signs of exudation into the pleura in the right axillary region, dyspnœa, and hacking cough with little expectoration. Later, when the abscess discharges into the bronchi, severe paroxysmal cough develops, with abundant expectoration, often greatly increased on lying down. The sputum consists of a "dirty-red or brownish puriform matter. There is no matter like it expectorated in any disease of the lung itself, and I believe that its appearance is pathognomonic of abscess of the liver, or, at least, of abscess perforating the lung" (Budd).

Case of abscess of the liver discharging through the lung. After several unsuccessful attempts, the abscess was discovered and drained. C. A. Morton (Lancet, Aug. 8, '96).

Two cases of amœbic abscess of the liver reported, together with the only one that could be found in the literature in which secondary perforation of the inferior vena cava resulted. Flexner (Amer. Jour. Med. Sci., May, '97).

Liver-abscesses may communicate with various organs and cavities. The most common secondary invasion is undoubtedly through the diaphragm into either the right pleural sac or directly into the lower lobe of the right lung. Thierfelder collected 170 cases of liver-abscess, of which 76 opened into the lung and bronchi, 23 into the abdominal cavity, 32 into the intestine, and 13 into the stomach. Aghetti collected 131 cases, of which 38 broke into the lung. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Aug., '97).

A slight degree of jaundice is not rare; it may vary with the variations of temperature. Exceptionally more marked and prolonged jaundice is caused by pressure of the abscess on the common bile-duct. Ascites may result in a similar manner from pressure on the portal vein.

Diagnosis.—As the suppurative process in the liver may be latent, it is often impossible to make a diagnosis of hepatic abscess, especially in the early stage.

A peculiar "hepatic odor" noticed in cases of abscess, especially well marked when the patient is confined in a small room. W. K. Hatch (Brit. Med. Jour., Nov. 10, 1900).

The occurrence of pain in the right hypochondrium or in the scapular region, some enlargement and tenderness of the liver, and irregular fever, usually with chills more or less marked, in a case with a history of ulcerative processes anywhere in the digestive tract affords fairly certain ground for a diagnosis.

Attention called to the perihepatic friction in suppurating hepatitis as a diagnostic sign that may be perceived both by ear and hand, and precedes by several days œdema of the parts. It is also evi-

dence that the liver is fixed to the abdominal walls by adhesive peritonitis. Bertrand (*La Sem. Méd.*, Mar. 9, '90).

The apparent enlargement of the liver, in a case in which abscess or cancer had been suspected, was apparent only, and was the result of a localized peritonitis, which had pushed the liver down. The organ was held down by fibrous bands, the result of organized lymph. Pepper (*Univ. Med. Mag.*, Aug., '91).

If discharge takes place through the lung the character of the pus may be sufficient to establish the diagnosis; especially if amœba be found in it, otherwise abscess of the lung or empyema will have to be excluded.

Of diseases in the liver-region abscesses of the base of the right lung are not uncommon and present many features of similarity. In both there is increased area of dullness, pain is similar in character and location, cough is a feature of each, and the constitutional symptoms are more or less parallel. The history leading up to the illness is quite dissimilar in most instances. Pulmonary abscess is constantly preceded by pneumonia; hepatic abscess by dysentery, suppurative processes within the bounds of the portal system, or suppurative cholangitis. The sputum from a ruptured abscess of the lung is of purulent nature, stained with blood, while that from abscess of the liver is often of reddish-brown color, like anchovy-sauce.

The pulsating pleurisy, encysted empyema, and subphrenic abscess are also affections extremely difficult and often impossible of differential diagnosis. In pyothorax dyspnoea is ordinarily more pronounced, and there may be a slight resonant space between the pleural pus-collection and the liver.

In suppurative appendicitis, the previous history, the presence of the tumor, the location of the pain, the resistance of the abdominal muscles, together with the absence of functional disturbances of the liver, generally suffice to clear away all doubt.

In paranephric or perinephric abscess of the right kidney it is well to remember

that this is frequently the result of disease of the kidney, or by extension of inflammation from neighboring parts, that its origin is never spontaneous, that it occurs twice as often in adult males as in females. Pain and swelling in the lumbar region are the localizing symptoms. John G. Cecil (*Amer. Pract. and News*, Apr. 17, '97).

Question of leucocytosis in amœbic abscess of the liver emphasized. In one of his cases on admission the leucocytes were only 6000 per cubic millimetre, and only once rose to 11,000; in another 9000 per cubic millimetre; in another 22,000, and in another 15,000. Three of the writer's cases had practically no leucocytosis. The statement should be modified that leucocytosis is always present in abscess of the liver. That amœbic abscess of the liver is not always associated with existing ulceration in the intestine has been proved by one of his cases. Patients may have had dysentery months before and the ulceration heals completely. William Osler (*Medical News*, April 12, 1902).

Perforation externally may render diagnosis easy. If the abscess is in the liver the needle inserted into it will move with the respiratory movements of the liver unless adhesions be so firm that the liver is quite fixed. Empyema of the gall-bladder would, of course, move with the liver, as might also an abscess adherent to the under surface of the liver.

Attacks of gall-stone colic with marked intermittent fever often closely simulate hepatic abscess. In the gall-stone cases the attacks of fever are paroxysmal, with severe pain, and sweating. The attacks may recur with great regularity. In the intervals between the attacks there is complete apyrexia, and the general nutrition is well maintained. Such a history may be continued for years.

Case in which abscess gave passage to thirty gall-stones. Covert (*Chicago Med. Times*, Aug., '95).

As abscess of the liver is a secondary affection, the previous history is important. The primary disease may be dysentery, ulcer of the stomach, hæmorrhoids, rectal ulcers, appendicitis, etc.

Certain cases of enteric fever present a clinical picture resembling liver-abscess. The type and course of typhoid, when unmodified by antipyretics, in comparison with the more erratic chill, fever, and sweat of hepatic abscess is sufficient, together with the other usual manifestations of typhoid, to make the distinction clear.

Cancer of the liver differs from an abscess by its dissimilar history, by the hard nodular masses, and by absence of fluctuations. Further, the marked fever and other constitutional symptoms are not like what occurs in hepatic cancer. In cancers the superficial veins are enlarged and œdema of lower extremities common. From a suppurating hydatid cyst of the liver an abscess can scarcely be diagnosticated. John G. Cecil (*Amer. Pract. and News*, Apr. 17, '97).

The most common error is to regard the hectic of liver-abscess as attributable to malaria. If carefully considered there are several circumstances which should obviate this error:—

1. No uncomplicated ague resists quinine in full doses.

2. In malaria, if the liver be enlarged, the spleen is still more so; the reverse is the case in liver-abscess.

3. The plasmodium cannot be found in the blood in non-malarial hepatitis.

4. In liver-abscess the fever is almost invariably an evening one; in malaria it most frequently comes on earlier in the day.

5. Quotidian periodicity, contrary to what is the case with tertian or quartan periodicity, is by no means pathognomonic of nor peculiar to malaria.

6. The almost invariable history of antecedent dysentery or, at least, of intestinal disorder in liver-abscess. Ed. E. Field (*Ga. Jour. Med. and Surg.*, Dec., '98).

In three cases the leucocyte-count ranged between 19,000 and 26,000. These figures are of no diagnostic value, inas-

much as a hyperleucocytosis of similar grade is found in a variety of hepatic disorders other than abscess. In the fourth case the leucocytes numbered 40,000, but here there was present an ulcerous phlebitis of the inferior vena cava. Differential counts showed an excess of polymorphonuclear leucocytes. Mosse and Sarda (*Gaz. Hebdomadaire de Méd. et de Chir.*, Dec. 26, 1901).

The writer emphasizes the importance of counting the white cells, by the absence of a leucocytosis he could rule out a number of cases of typhoid, malaria, and nephropylitis which closely simulated hepatic abscess. It is not proper to depend solely upon the number of leucocytes in deciding when to operate and the temperature and local symptoms must also be taken into account. After an abscess has been opened, all the symptoms generally disappear, so that the diagnosis of a second abscess may be impossible. Here, again a leucocyte count proves invaluable. The white cells generally sink very slowly; if they remain high for several days and complications can be ruled out, it is probable that there is another focus in the liver. The temperature curve is less reliable, since even with complete evacuation of pus there may be quite a post-operative rise. Larger abscesses, requiring further operation, will generally show more than 20,000 leucocytes; the smaller ones with 15,000 to 20,000 cells will often be absorbed spontaneously or become latent. An exacerbation of a dysentery or peritonitic processes may also be the cause of leucocytosis. D. Schlayer (*Münch. med. Woch.*, Aug. 11, 1903).

The existence of leucocytosis may prove of importance as indicative of suppuration. The diagnosis may sometimes be established by aspiration: an operation that may be resorted to without any great degree of danger. Of course, failure to find pus does not negate the existence of abscess, as the needle may not reach it or the contents may be too thick to enter the needle. The patient should be anæsthetized, as many punct-

ures may be required. The needle should be inserted in the lowest interspace in the anterior axillary line, in the seventh interspace in the midaxillary line, or in the centre of the dull area behind. The needle should be used only to determine the necessity for drainage.

Etiology.—Abscess of the liver results occasionally from traumatism, as from a blow or a punctured wound.

Abscess of the liver is a rare condition in children, except as the result of injury, but traumatic abscess is relatively more common in them than in adults. This relative frequency is probably due to the occurrence of blows or injuries on the abdomen, to which children are more subject than adults. Sometimes the abscess develops immediately after the injury, while at other times a latent period intervenes, during which time the symptoms are in abeyance. Generally the injury has been applied directly over the hepatic region, in which case the abscess is primary. Occasionally an abscess of the liver results from an injury to some other part of the abdomen, when the resulting abscess is secondary or indirect. The symptoms of a traumatic abscess of the liver are local pain, swelling, and fluctuation; at the same time there is fever, either remittent or continuous, and rapid and profound cachexia in every case. The natural tendency of the liver-abscess is to rupture, either through the skin or through the respiratory passages. In the latter case the abscess discharged either through the bronchi or into the pleura, setting up a purulent pleurisy or a pyopneumothorax. The evacuation is followed generally by a rapid amelioration of the symptoms, but in every case surgical intervention brings about a more certain and rapid cure of the condition. Oddo (*Rev. Mens. d. Mal. de l'Enf.*, Jan., 1901).

Apart from traumatism, the two chief avenues by which bacteria gain access to the liver and excite suppuration are the portal vein and the bile-ducts. Of these,

the portal vein is the chief one, as it may convey germs from any part of the digestive tract; hence the frequency with which abscess of the liver follows ulcerating lesions of the intestines, as dysentery, appendicitis, hæmorrhoids, and other rectal diseases.

Formation of gall-stones regarded as most frequent cause of liver-abscess in Germany. W. Korte (*Deut. med.-Zeit.*, July 28, '92).

A case of abscess of the liver following typhoid fever in which the pus of the abscess contained the bacillus of typhoid. Abscesses of the liver following this disease divided into those due to metastasis, those due to typhoid ulceration of the biliary passages, and those due to typhoid pyelophlebitis. Lannois (*Rev. de Méd.*, Nov., '95).

Alcoholism evidently plays a predisposing part in the production of liver-abscesses; but the determining cause is an ascending angiocholitis of intestinal origin. Adamidi (*Inter. Congress of Med.*; *Brit. Med. Jour.*, Oct. 13, 1900).

Persons living in hot climates are more liable to hepatic disease in the course of typhoid fever than are others. Other than this there is nothing to suggest the possibility of abscess-formation in any case of typhoid, as this complication may arise in mild or severe cases. The symptoms of suppurative hepatitis in course of typhoid are practically the same as those of any other form. They generally appear suddenly toward the fourth and fifth week, when the temperature appears to be declining. The temperature again goes up somewhat rapidly, and there may be a sharp rigor and then pain, and the other symptoms of hepatitis appear. The sudden onset of hepatitis is very similar to that of perforative peritonitis, cholecystitis, angiocholitis, or pleurisy. Cassuto (*Thèse de Paris*, 1901).

Emboli from these sources may excite suppurative pyelophlebitis, from which abscesses may result by extension into the liver-substance.

A case of abscess of the liver due to pyelephlebitis following typhoid fever. Schultz found no instances among 3686 patients with 362 fatal cases; Romberg saw 1 among 677 cases, with 88 deaths; Dopfer saw 10 in 927 autopsies. There was no cause for metastatic abscess nor any typhoid ulceration of the biliary passages or gall-bladder. The abscess was due to ascending thrombosis beginning in the intestines, and the bacillus of Eberth was found in the abscess. Lannois (Rev. de Méd., Nov., '95).

A case of abscess of the liver which developed a few months after perityphlitis. Fränkel's diplococci were found in the pus. Hermes (Deut. Zeit. f. Chir., No. 6, '96).

Infective processes in the umbilical cord in infants may extend along the vein to the liver and produce one or more abscesses. In a similar manner they may result from abscess of the spleen.

In general pyæmia abscess of the liver is rare, as the germs have to pass through the lungs to reach the liver. Suppurative wounds of the head are, however, followed by hepatic abscess with comparative frequency. It may possibly happen in these cases that the infectious agent reaches the hepatic veins by "retrogressive embolism" from the vena cava.

Next to the portal vein, the most common avenue of invasion of the liver by pyogenic organisms is the bile-duct. The germs originate in the intestine, and the inflammation resulting from their presence in the duct is probably always preceded by injury, usually from pressure of a gall-stone, more rarely from the irritation of a parasite.

Abscess of the liver caused by a pin. Both the head and the stem of the pin were incased in calcareous matter, so that it measured nearly three millimetres in diameter. Alexander Lambert (N. Y. Med. Jour., Feb. 5, '98).

In tropical climates there is close association between abscess of the liver and dysentery: an association apparently ex-

plained by the discovery of the presence in both of the amœba coli. But the amœba is not found in all cases of hepatic abscess in hot climates, and probably other organisms are the active agents in the production of many cases.

In a tropical hepatic abscess not dependent upon dysentery, pure cultures of staphylococcus pyogenes aureus found. Amœbæ were not present. Macfadyen (Brit. Med. Jour., July 15, '93).

Several cases of multiple abscess of the liver reported. In the pus of one, the staphylococcus pyogenes albus; in another, the staphylococcus pyogenes aureus and a streptococcus; in a third, a staphylococcus and the bacterium coli commune were found. Clark (Practitioner, Oct., '93).

Sterile pus is found mostly in old abscesses, while the acute ones contain micro-organisms; therefore, hepatic abscesses are of microbic origin, but the microbes die rapidly in their pus. Laveran (Le Bull. Méd., Dec. 6, '93).

Bacteriological examination of the pus of an abscess of the liver following dysentery revealed many micro-organisms, as the staphylococcus pyogenes, the bacillus of Eberth, and a microbe not yet determined. The pus of these abscesses is not sterile, or such a sterility is only apparent. Nertrand (Le Bull. Méd., Apr. 18, '94).

A case of dysentery followed by abscess of the liver in which the amœba coli was found in the abscess-cavities, though none was discovered in the intestines post-mortem. Manner (Wien. klin. Woch., Feb. 20, '96).

The statistics collected by Councilman and Lafleur show that in India in 142½ autopsies on persons dying of dysentery, liver-abscess occurred in 306. In Algiers, of 1001 autopsies on dysenteric cases, 180 had liver-abscess. According to Kartulis, of 500 cases of dysentery, from 50 to 60 per cent. had liver-abscess. Of 40 American cases personally collected, 18 had liver-abscess. Liver-abscess may occur in the acute form of dysentery, but it is more common in the chronic variety. W. T. Howard, Jr., and C. F. Hoover (Amer. Jour. Med. Sci., Aug., '97).

There is a special form of dysentery in which amœbæ are constantly present and also in the pus of certain tropical abscesses of liver the same bodies are found. Amœbæ coli have been found in the stools of patients who were not at the time suffering from dysentery. This fact may account for some cases of hepatic abscess in which there is no trace of a dysenteric connection. C. W. Windsor (Lancet, Dec. 11, '97).

Case of hepatic abscess without history or symptoms of dysentery; yet the amœba coli was found in abundance in the pus which escaped after incision. G. R. Turner (Lancet, Feb. 15, '98).

Hepatic abscess may originate in patients who many years previously have suffered from dysentery. Jossierand (Jour. de Méd., July 25, '98).

Pathogeny as studied in seventy-two cases of abscess. The affection is not purely exotic. Most of the patients have been alcoholics, and cirrhosis caused by alcohol predisposes to hepatic suppuration. Giordano (Inter. Congress of Med.; Brit. Med. Jour., Oct. 13, 1900).

Amœbic dysentery is most frequently found in patients dying from large tropical liver abscess, in the walls of which amœbæ can always be found, unless they have been opened for some time. The disease is chronic, and often latent, and not very often fatal by itself, but usually through complications. The disease presents naked-eye and microscopical characters which enable it to be easily distinguished from the more common bacillary type of the disease. Its most important complications are large abscess of the liver, chronic or acute peritonitis, and postperitoneal abscess. Amœbic abscess of the liver secondary to this form of dysentery may be produced (1) by infection across the peritoneum, with or without previous adhesions; or (2) through infection by the portal vein, producing sufficient clotting in its branches to cause a fæcal necrosis in one or more parts of the liver, concentric extension taking place by means of a similar process. If staphylococci reach the liver with the amœbæ, as especially occurs when gangrenous slough-

ing of the bowel wall complicates amœbic dysentery, then multiple small abscesses in the interlobular branches of the portal vein containing both amœbæ and staphylococci result. The bacillary form of dysentery is much commoner in Calcutta than the amœbic one and is due to Shiga's bacillus, which is clumped by the blood of cases of ordinary dysentery, although not by that of the amœbic form, thus furnishing a means of differentiating between them clinically. Rogers (Brit. Med. Jour., June 6, 1903).

Morbid Anatomy.—In septic cases the abscesses are usually multiple and irregularly distributed throughout both lobes. Traumatism may give rise to a solitary abscess, and such may also result from a single embolus. The liver is usually uniformly enlarged. Its surface may present no abnormal appearance. In many cases, however, there are yellowish points showing beneath the capsule. On section isolated pockets of pus are found varying in size from a small point up to three or four cubic millimetres or more in diameter, the larger ones being probably formed by the coalescence of two or more smaller abscesses. Many are dendritic in form, and on examination are found to communicate with the portal vein, being doubtless formed by suppuration of its branches. The walls of the abscesses are shreddy, especially in the larger ones, and the cavity may be divided by many trabeculæ. The contents vary according to the age of the abscess and the nature of the infective agent: they may be thick and viscid; or fœtid, bile-stained, and containing masses of necrotic tissue; or the pus may be thick and laudable. All the branches of the portal vein in the liver may be involved, but sometimes thrombi circumscribe the infection and preserve sections of the liver from invasion. The suppurative

process may extend backward even into the gastric and mesenteric veins.

The small abscesses may be microscopical in size. Their contents consist of firmly granular material, with here and there cellular and nuclear fragments, and in some there is fibrin. Few, if any, leucocytes are seen, but red corpuscles may be numerous. Amœbæ are always numerous in the smaller abscesses, being more numerous about the periphery, extending in places into the liver-tissue, but not usually beyond the area of tissue-necrosis. A few may be found in the capillaries. W. T. Howard, Jr., and C. F. Hoover (*Amer. Jour. Med. Sci.*, Aug., '97).

Modern pathology warrants the conclusion that hepatitis and dysentery are alike in their elementary lesion, which is a necrosis, and that they only differ in their course on account of the difference between structure in liver and intestines. Kelsch and Minier (*Bull. de l'Acad. de Méd.*, Mar. 6, 1900).

Liver-abscess and appendicitis. Reginald Fitz in 257 appendicitis found 11 examples of suppurative phlebitis and hepatitis; Langheldt in 112 autopsies of appendicitis shows 4 cases of phlebitis and thrombosis, 2 of abscess of the liver, 2 of suppurative hepatitis, 2 of perihepatitis; Einhorn in 100 appendicular post-mortem examinations found 6 complicated by infectious embolism of the portal vein, accompanied by pyophlebitis and by secondary abscess of the liver; Coley among 200 cases of appendicitis notes 2 of the liver and 1 of subphrenic abscess. E. Loison (*Revue de Chir.*, p. 522, 1900).

Analysis of 79 cases from the Institute of Pathology and Anatomy of Vienna. Thirty-one of these occurred in connection with occlusion of the bile-ducts (23 gall-stones, 7 carcinoma, and 1 ascaris lumbricoides). Seventeen were secondary to disease in the portal area (6 disease of the female genital organs, 4 dysentery, 3 typhlitis, 1 pancreatic abscess, and 1 suppurating hæmorrhoids). Thirdly, pyæmia accounted for 13 cases, and, fourthly, in 18 either the cause was not discovered or arose from echinococcus (8 cases) or contiguous

suppuration (4 cases). Kobler (*Virchow's Archiv*, B. clxiii, H. 1, 1901).

If infection has taken place through the bile-ducts, obstruction by gall-stones usually exists and the gall-bladder and the bile-ducts generally may be dilated and full of pus, often bile-stained.

Very large abscesses may result from suppuration around echinococcic cysts; their nature is indicated by the presence of portions of the cysts.

TROPICAL ABSCESS.—There may be one or more; in the latter case there is usually one larger and evidently much older than the others. They may vary in size from a few millimetres in diameter up to an orange or even to a child's head. The larger abscesses usually occupy the right lobe, being situated, as a rule, at the under surface above the hepatic flexure of the colon or in the dome of the liver (Lafleur). In Waring's statistics of three hundred cases, in 62 per cent. there was only a single abscess. The small multiple abscesses are usually superficial. In the smaller abscesses, being more recent, the walls are shreddy and not sharply defined from the contiguous inflamed liver-substance. Their contents vary from a yellowish gray to a reddish-brown (due to the presence of blood), and often contain shreds of necrotic liver-tissue. In old abscesses the walls are firm, thick, and fibrous. The contents of all the abscesses are chiefly remarkable in the small number of leucocytes that are present.

Case of tropical abscess of the liver containing the amœba coli, in which the discharge from the abscess was examined from day to day. On the sixth day after the operation it was found that the leucocytes had very greatly increased, that the amœbæ were rapidly disappearing, and that, while bacteria had previously been absent, there had now appeared Fränkel's pneumococci, streptococci, and the colon bacillus. Peyrot and Roger (*Rev. de Chir.*, Feb., '97).

When the abscess is single it is far more frequently found in the right lobe and nearer to the upper surface. Waring found that out of 288 cases of tropical abscess 177 were single. The pus from a true tropical abscess shows a complete absence of pyogenic organisms. Osler expresses the opinion that the pus of tropical abscess is quite free from pyogenic bacteria. Macfadyen holds that in tropical abscesses pyogenic organisms are constantly met with, staphylococcus pyogenes aureus being the commonest, while the staphylococcus albus and streptococcus pyogenes are often found. C. W. Windsor (Lancet, Dec. 4, '97).

When the abscess reaches the surface it may rupture and pus escape into the peritoneal cavity, or, adhesions having previously formed, the pus may penetrate in any direction. It may discharge into the stomach, the intestine, the pelvis of the right kidney, or through the diaphragm into the pleural or pericardial sac. Adhesion of the lung to the diaphragm usually precedes its advent in this direction, and then the lung is invaded, an abscess forming and discharging into the bronchi. It may also perforate the thoracic wall and appear beneath the skin.

Prognosis. — Suppurative hepatitis is a grave disease, the mortality being over 50 per cent. In rare cases of single small abscesses and of mild cases of pylephlebitis recovery possibly takes place by absorption or inspissation and calcification of the pus. There is, however, room for doubt as to the diagnosis of such cases. Multiple small abscesses are almost necessarily fatal, as they can rarely be evacuated either by natural processes or by surgical intervention. In large abscesses the mortality has been greatly reduced of late by the greater fearlessness and thoroughness with which they are operated on. Operation appears to give much better results in the ordi-

nary septic abscesses than in the amœbic variety.

Out of 88,416 deaths in ten years, in the city of Mexico, 1985 were due to hepatitis. Symptoms are jaundice, increasing in severity; signs of suppuration; compression of portal vein; rarely ascites; liver enlarged, but not the spleen. On section, the liver shows many, sometimes even 200, abscesses filled with a white or yellow-green pus. Mejia (La Sem. Méd., Aug. 27, '90).

Cases of abscess of the liver usually terminate favorably after rupture into the lungs. T. Glover Lyon (Lancet, Nov. 20, '97).

Treatment. — Apart from surgical means, little can be done, beyond relieving symptoms and maintaining the patient's strength, until the abscess discharges spontaneously or is accessible to the surgeon. Pain and cough are the chief symptoms to be relieved. In cases of rupture into the bronchi, cough is necessary for the removal of the pus, and should not be interfered with unless excessive.

In multiple abscesses and in suppurative pylephlebitis surgical measures are useless unless to open an abscess threatening to rupture. In single abscesses operation may promise fair success, especially in the non-amœbic cases. In cases in which the abscess is discharging through the lung operation should be deferred if the patient's condition is favorable, as some recover spontaneously.

An hepatic abscess, when seated in the upper and back part of the right lobe, is best treated by resection of a portion of the ninth or tenth rib, and transpleural laparotomy, the pleura being stitched to the diaphragm in the absence of adhesions. When the anterior portion of the liver is involved, the abscess should be exposed by anterior laparotomy, the edges of the external wound being stitched to the surface of the liver if practicable.

The inner surface of the abscess-cavity should not be scraped; simple injections

after incision are quite sufficient and less dangerous. Ricard (Bull. et Mem. de la Soc. de Chir., 1-2, '96).

The point of election in liver-abscess is the most dependent part of the collection, or the point showing a tendency to rupture. In absence of this the points of election are just below the ribs, or in the seventh intercostal space in mid-axillary line. In early operations, or before adhesions have formed, it is advisable to open the peritoneal cavity first, and pack it off by gauze, preliminary to opening the abscess. The subsequent management is similar to that of abscesses in general. John G. Cecil (Amer. Pract. and News, Apr. 17, '97).

The treatment of liver-abscess should be prompt, bold, and radical. No measure is successful which fails completely to evacuate the abscess and allow free drainage. This can be done with precision and safety only by incision. The line of incision is to be determined by the position of the abscess. George B. Johnston (Med. Record, June 5, '97).

Bleeding of the liver recommended in acute hepatitis of dysenteric origin. Whether it acts by relieving congestion or by withdrawing a certain number of micro-organisms and favoring leucocytosis cannot be told, but rapid improvement follows, and the recovery is so complete that no other form of treatment can bear comparison with it. Paul Remlinger (Revue de Méd., Aug. 10, 1900).

When the abscess discharges directly into the pleural cavity the one rule of treatment is to make a free opening into the pleural cavity, removing a portion of the rib if necessary, and to establish efficient drainage. When the lung-tissue is involved and abscess-formation has taken place, the case should be treated as one of lung-cavity and the exploration and incision made into the chest, and not by way of the liver. K. Macleod (Brit. Med. Jour., Sept. 1, 1900).

In order to reach the liver the peritoneum must be freely opened up without interfering with the costo-diaphragmatic *cul-de-sac*. The liver, having been exposed, is carefully isolated from the rest of the peritoneal cavity by means of sterilized compresses; the abscess is then

opened and drainage established without washing out. In 72 personal operations there were 42 cures. The fatal result in most of the 30 others in which the abscess recurred after operations was due to the fact that the latter had been too long delayed. Giordano (Inter. Congress of Med; Brit. Med. Jour., Oct. 13, 1900).

Manson's method of treating deep-seated liver-abscess is to tap the abscess by a large trocar and cannula, introducing a large drainage tube stretched upon a metal rod through the cannula and applying siphon drainage to carry off the pus. Of 4 cases operated upon within the last year, 3 recovered and 1 died. These 4 cases complete a series of 28 operated upon by this method by the author, of which 4 died. He is more convinced than ever of the efficacy and safety of treating liver-abscesses by the trocar and cannula, and is still more ready to condemn operations by the knife. He believes that the operation should be done as soon as pus is suspected, and that the surgeon should not wait until the abscess has pointed on the abdominal wall or the chest-wall. J. Cantlie (Brit. Med. Jour., Sept. 14, 1901).

Study of 16 cases of abscess of the liver complicating dysentery, on which operation was performed, and upon the study of a still larger number of cases which did not come to operation. When abscess of the liver is suspected the usual practice is either to attempt its localization by aspirating, or to temporize until the abscess is of such size that its location is manifest. The author asserts that neither of these methods should be followed. An exploratory incision should be resorted to at once. Through this incision the liver may be readily palpated and a little experience will enable the operator to locate even a deep abscess. Pus having been located, it can be evacuated by only two routes: Through the exploratory incision or through the chest wall. 1. Evacuation through the original incision. The field of operation is carefully walled off with gauze; the capsule of the liver incised, and through this last wound a broad ligament clamp is

pushed into the abscess cavity and the pus is evacuated. Fresh gauze is now introduced to protect the surrounding tissues from contamination and the abscess cavity is drained. If there is more than one abscess the procedure just described must be repeated. 2. Evacuation through the chest wall. If the abscess is on the upper and posterior surface of the gland it cannot be reached through the exploratory incision in the anterior abdominal wall. Therefore the following method must be employed: The chest wall opposite the accumulation of pus is nicked with the knife. The exploratory incision is closed and a new incision is made at the site indicated by the nick. The abscess is evacuated as already described. The author discusses the method he recommends of treating liver abscesses in great detail. For the treatment of the dysentery nothing equals in efficiency sweet oil. This statement is based on the study of 800 cases treated in the Government Hospital at the Presidio, Cal. The diet is of the greatest importance. Milk and soups made with milk should be absolutely forbidden. Rhoads (American Medicine, Oct. 24, 1903).

Tumors of the Liver.

Of these, secondary carcinomata are, by far, the most common. Primary carcinoma, sarcoma, angioma, and lymphadenoma also occur. Myxoma, cysto-sarcoma, and fibroma are rare forms. Cancer of the liver is met with in about 3 per cent. of deaths from all causes, and in all persons affected with cancer the liver is the seat in 50 per cent. of the cases, the liver being third in order of frequency of internal cancer.

Symptoms.—In many, perhaps half, of the cases of cancerous disease of the liver there are no symptoms by which the disease can be recognized during life. The symptoms of the primary growth usually overshadow those caused by the liver disease. The stomach is the seat of the primary growth in more than a quarter

of all cases; so that symptoms of digestive disturbances are usually prominent, such as loss of appetite, distress after food, nausea, and vomiting. Progressive loss of flesh and strength is an early symptom. Pain and uneasiness in the hepatic region are common, but in many cases of even extensive disease of the liver neither is present. No doubt both are often due to local peritonitis.

Progressive enlargement in malignant disease is almost invariable. When irregular, the growth is generally secondary. Tenderness and pain is usually experienced. When the growth is deep-seated, pain may be but little marked or absent. Outlying secondary growths may form on the falciform ligament. Gastric derangements are frequent. Hæmorrhages into the skin may occur with or without jaundice. Jaundice and ascites are accidental symptoms. They both occur in about half the cases. In rare cases the ascitic fluid may be chylous. Emaciation of a steadily progressive type is most characteristic. Death often occurs within three months of the onset of symptoms. Cachexia is an important diagnostic sign.

Primary malignant disease of the liver seems to be more frequent in men than in women. Secondary growths are usually carcinomatous. H. D. Rolleston (Clin. Jour., Mar. 3, '97).

The liver is usually enlarged. Hepatic dullness may extend upward to the fifth rib in the midaxillary line, to the left as far as the spleen, and the lower edge may be felt at or below the umbilicus. The lower edge and anterior surface below the costal margin are hard and often uneven on account of the nodular deposits. The nodules in some cases are felt to be umbilicated: an absolutely diagnostic sign. In cases of diffuse infiltration the liver may be very large; occasional instances are met with in which it is smaller than normal. The surface is smooth and hard and usually tender.

Jaundice is present in about half the cases. It is usually slight at first, becoming deeper toward the end. It is usually due to pressure on the common bile-duct in the transverse fissure by carcinomatous glands; it may be due to pressure on the branches in the liver by growing nodules, or if the primary growth is in the head of the pancreas it may press on the common bile-duct. It is important to remember that cancer of the liver is the most frequent cause of long-standing jaundice; it is permanent, and in the later stages may become extremely deep.

Case of cancer in which detached portion caused symptoms of lithiasis; obstruction caused jaundice; glands of hilum gave rise to circulatory symptoms, while consecutive cirrhosis further complicated the case. Gilbert, Claude (*Archives Gén. de Méd.*, May, '95).

Ascites occurs in some cases, and is caused by pressure on the portal vein or to extension of the cancer to the peritoneum. It is present in the cirrhotic form of cancer.

The superficial veins are enlarged. Some fever is not rare, continued or intermittent, especially when the disease runs a rapid course. It may occur in simple cancer, or may indicate suppuration. Hæmorrhages into the skin or from the mucous surfaces may occur late in the disease.

Course and Duration.—Death usually results within a few months; it is rarely delayed beyond a year after the symptoms have declared themselves. Occasionally the progress is delayed for some weeks at a time, during which some improvement may take place in the general condition. Death is usually due to progressive debility, with, in the last stage, some infection that closes the scene.

Diagnosis.—The occurrence of progressive loss of flesh and strength, of pain

and tenderness in the hepatic region, and of rapid enlargement of the liver, with the formation of nodules, forms a fairly sure basis for diagnosis. Even with this symptom-group, difficulties may beset us.

Certain cases of hepatic cancer closely resemble terminal stages of heart disease. But in latter slighter diminution of urea and albuminuria present, whereas absent in cancer,—main differential points. Hanot, Flu (*Jour. de Méd. et de Chir. Prat.*, Aug. 16, '95).

Case in which cancer was only recognized post-mortem, owing to absence of all usual symptoms. Dupont (*Archives Méd. Belges*, Sept., '95).

Enlargement of the spleen in cases of carcinoma of the liver is quite an unusual occurrence. There are, however, occasional exceptions to the rule, and carcinomatous tumors may be found in the latter organ as well as in the liver. Enlargement of the left lobe of the liver, however, and the development of a carcinomatous mass contiguous to, though not involving, the spleen may be mistaken for enlargement of the spleen, and thus assist in producing an erroneous conclusion respecting the condition of the latter organ. C. O. Hawthorne (*Edinburgh Med. Jour.*, June, 1901).

Apparent enlargement of the liver may be due to hardened fæces in the transverse colon, which is tender, owing to the enteritis caused by the hard masses. Indurated puckered omentum and tumors of the stomach, kidney, and the abdominal wall may also simulate a large liver. The large cirrhotic liver may, in the early stage, be mistaken for cancer, as the liver is large and the jaundice usually well marked; but the liver is smooth and not tender and there is absence of the cachexia of cancer. The spleen is also large.

Syphilitic disease in which there is large amyloid liver with gummatous nodules may present some difficulties, as may also echinococcic liver with large

cysts. In both, the history is more prolonged and there is absence of cachexia and usually of jaundice. Ascites is strongly indicative of cancer. The early period of cancer with cirrhosis may be indistinguishable from atrophic cirrhosis; there is similar jaundice and ascites in both, but later the cachexia is more marked in the cancerous form.

Melanosarcoma usually involves other organs as well. It may cause great enlargement of the liver. Secondary tumors may form in the skin. In many cases there is melanuria: a characteristic symptom. Great difficulty is often experienced in differentiating cancer of neighboring organs from cancer of the liver, especially if they are adherent to the liver.

The chief interest in tongue-like accessory lobes of the liver is in connection with the diagnosis of abdominal tumors. Unless fully alive to the great variety, as to shape and position, in which the accessory lobes of the liver may present themselves, one will often be misled. McPhedran (*Canadian Pract.*, June, '96).

In all cases of doubt in neoplasms of the liver, it is advised to explore the hilum of the liver to see if there are any enlarged glands present; if present, they show a metastasis from a malignant growth, and puncture is unnecessary; but their absence does not exclude a malignant growth, for if it is a secondary growth the metastasis would not be through the lymphatics, but through the venous channels, and the glands would not be enlarged. Primary cancer of the liver shows metastasis in the glands situated at the hilum. Tuffier (*Gaz. Hebdomadaire de Méd. et de Chir.*, Jan. 28, '97).

A very handy and accurate method of recording the size and position of abdominal organs or tumors has been called the Keith method. It consists in first carefully percussing out the organ,—say, the liver. The limits of percussion-dullness are then marked on the skin by black paint (Indian ink). Then with red paint the ribs are mapped out by a broad band drawn on the skin over each

rib. When the coloring fluids have dried, a piece of thin, transparent muslin is placed over the front of the body, large enough to cover the body from the clavicles to the pubes. With red paint the red lines over the ribs, the arch of the subcostal angle, the nipples, and the umbilicus are then traced on the muslin, and finally the brush is drawn along the black outlines of the liver as they are seen through the muslin. On the muslin the patient's name and the date of drawing, as well as the disease should be painted for future reference and comparison with note-book. By this method one preserves a life-sized drawing of the liver, and a permanent record. James Cantlie (*Clin. Record*, June 22, '98).

Etiology.—Cancer of the liver is most frequently secondary to cancerous disease in the organs connected with the portal circulations. Hence it occurs secondarily to cancer of the stomach, rectum, colon, œsophagus, gall-bladder, bile-ducts, and pancreas. It also follows cancer of the uterus and ovaries and the mammary gland.

Tumors of the liver occurring as primary growths are very uncommon. They may spring from the epithelial structure, adenomata and carcinomata representing this type, or from the connective tissue, as represented by fibro-neuromata and sarcomata. Secondary carcinoma follows a primary growth in the stomach in about 25 per cent. of the cases. G. R. Fowler (*Medical News*, Feb. 8, 1902).

It occurs usually in late adult life, especially between the fortieth and sixtieth years, but may occur in children. The relative frequency of its occurrence in the sexes is doubtful; some observers state that it is more frequent in males, others in females. My own experience coincides with the former. Inquiry is a doubtful cause and cancer of the bile-ducts is frequently associated with gall-stones, but whether as a cause or a result is uncertain.

Morbidity Anatomy.—As the primary

growth is situated in some organ whose blood is carried to the liver by the portal vein, the liver becomes early affected, and often is the seat of large deposits at the time of death. The deposits are in the form of whitish nodules scattered irregularly throughout the liver just as we would expect, in view of infection through the blood of the portal vein. The nodules vary in size from a microscopical point up to a mass occupying a large portion of the organ. As they grow in the direction of least resistance they appear early beneath the capsule, and if the abdominal wall is thin they may be felt and even seen through it. They may be firm from fibrosis or soft from degeneration; the former shows umbilication on the surface, owing to contraction of the fibrous tissue. The masses are globular, but coalescence may result in the formation of large irregular masses presenting, on section, a striking contrast to the liver-tissue. Their color may be a bright yellow, from bile-staining; dark-red, due to hæmorrhage; or pale yellow, from fatty degeneration.

The secondary cancers are of the same structure as the primary one from which the infection was derived: usually alveolar or cylindrical carcinoma. The peritoneum over them may be thickened and strong adhesions formed with the abdominal wall or diaphragm. Usually some of the bile-ducts are compressed, obstructing the flow of bile.

PRIMARY CANCER OF THE LIVER.—Of this there are three forms:—

(a) A simple large tumor with well-defined boundaries. It is usually grayish white, but may be the seat of hæmorrhage.

(b) *Nodular growths* are the most common, and the whole liver resembles the appearance it presents when it is the seat of secondary carcinoma.

(c) *Cancer with Cirrhosis*.—This is a remarkably rare form. In it the cancer-cells are uniformly diffused through the liver; so that the fibrous tissue is increased in all directions. This may contract and cause the liver, which at first is enlarged, to become smaller than normal. The organ looks like a coarse cirrhosis. When cut there are wide white bands seen running through the organ, the gland-tissue between them having vanished. Secondary growths in other parts of the body scarcely ever occur.

Out of 258 cases recorded in the Berlin Pathological Institute from 1880 to 1889, only 6 cases of true primary cancer of the liver found, and of these 2 are doubtful. Hansemann (Berliner klin. Woch., Apr. 21, '90).

Cirrhotic cancer arises from an hyperplasia of the hepatic epithelium independent of the cirrhosis, although the latter may favor the development of the carcinoma. Siegenbeck Van Heukelom (Ziegler's Beiträge, B. 16, H. 3).

Case of primary cancer of the liver with secondary cancer of the stomach, periportal glands, pancreas, and vena cava. The mass occupied nearly the entire right lobe of the liver. At no place was it covered by more than two centimetres of liver-tissue. Martin and Hamilton (Montreal Med. Jour., Apr., '96).

Primary carcinoma may be: 1. Massive, more often found in the right lobe, where the liver is expanded like a shell around the growth. 2. Infiltrating, the growth being diffuse, of comparatively slow growth, and so hard as to simulate cirrhosis. 3. Nodular, when the appearance is similar to that due to secondary growths. 4. Carcinoma with cirrhosis. H. D. Rolleston (Clin. Jour., Mar. 3, '97).

SARCOMA.—Two forms occur: primary and secondary. The primary cannot be distinguished at the bed-side from carcinoma, and even after death it is often difficult to differentiate them. The disease is extremely rare.

In case of primary sarcoma of the liver in a child 4 months old there was no

icterus, but the abdomen was enormously distended. At the necropsy the liver was found to contain numerous disseminated tumors of a light red-brown. The growth consisted of small round-cells, which seemed to originate from the endothelium of the interacinous blood-vessels and penetrate into the veins, where they compressed the liver-cells. Lendrop (*Hospitid.*, p. 217, '93).

Case of primary sarcoma of the liver. Increase in the size of the abdomen continued for three months without symptoms, when fæces became black and the urine dark. Later the abdomen increased still further in size and nodules could be felt. He had anasarca downward from the eighth rib and marked ascites. The skin showed slight icteroid discoloration, the thorax was negative, the abdomen was enormously distended, and hepatic dullness commenced at upper border of fifth rib; lower edge of the liver was irregular and could be felt in the neighborhood of the umbilicus. Death occurred as a result of œdema of the lungs. C. von Kahlden (*Ziegler's Beiträge*, vol. xxi, H. 2, '97).

Secondary sarcomas of the liver exactly reproduce the form of the original growth. The patient usually dies before any symptoms are produced by them. Melanosarcoma is the most important form; it develops in the liver secondarily to sarcoma of the eye or of the skin. It is very rarely primary. The liver is greatly enlarged, and is affected by uniform infiltration or by nodular black masses. In the former case the cut surface is studded with black or brown granules. There are usually metastases, affecting in some cases every organ in the body. Nodules of melanosarcoma in the skin may guide to the diagnosis. (Osler.)

[Melanuria seems to be so nearly constant a symptom of melanosarcoma as to be of considerable value in the diagnosis of obscure cases. There is good reason to believe that it only appears when metastases have occurred in the internal organs, especially the liver. It is not,

however, pathognomonic. F. C. SHATTUCK, *Assoc. Ed.*, Annual, '90.]

Case of melanotic sarcoma in which liver weighed 13 pounds 10 ounces. Codd (*Birmingham Med. Rev.*, June, '95).

Case in which there was a large liver with pain in the abdomen and delirium. The urine was dark red in color and on standing became darker. It contained some sugar, and upon the addition of Fe_2Cl_6 became black. There was some leucocytosis containing pigment, and there was also some free pigment in the blood. Diagnosis of melanotic sarcoma of the liver confirmed by autopsy. Pickler (*Zeit. f. Heilk.*, B. 17, H. 2, 3).

Liver-sarcoma tends to assume an alveolar arrangement. Kahlden (*Beit. z. path. Anat. u. z. Path.*, B. 20, H. 2, Jena, '97).

OTHER FORMS OF HEPATIC TUMOR.—Cavernous angioma are common, but produce no symptoms during life. They occur as small, reddish bodies, and consist of dilated blood-vessels. They have produced large tumors in children occasionally.

Adenomata observed: 1. Post-mortem, in subjects affected with atrophic cirrhosis or rarer disease. 2. In subjects presenting a cirrhosis of extremely-rapid progress, persistent icterus and enlargement of the liver being added to the ordinary symptoms. 3. In cases the symptoms of which do not resemble those of cirrhosis, but of neoplasm. Darier (*Bull. de la Soc. Anat.*, No. 12, '92).

Case of Laennec's atrophic cirrhosis of rapid development accompanied with icterus and associated with adenoma of the liver, occurring in a male. There was extensive œdema and ascites. The spleen was enlarged and diffuent, the kidneys enlarged and congested. Dufournier (*Bull. de la Soc. Anat.*, No. 21, '92).

Case of tubular adenoma of the liver in a man aged 60 years. Death occurred from rupture of the liver. Vanni (*Rivista Clinica e Terap.*, Apr., '93).

In man the liver is, perhaps, the most frequent seat of angiomata. Adami (*Montreal Med. Jour.*, July, '94).

Treatment.—As cancer of the liver is invariably fatal, nothing can be done

beyond allaying the pain, relieving the gastric disturbance, removing ascitic fluids if excessive, etc.

Large portions of the liver can be removed without undue disturbance of the function of that organ; the escape of bile into the peritoneal cavity is not a usual phenomenon after such an operation, and it may be generally prevented either by searing the raw surface of the liver, by ligation, or by securing the stump in the abdominal wound, and even if the bile does enter the peritoneal cavity the result is not necessarily fatal; hæmorrhage need not be greatly feared, as vessels can often be tied separately or *en masse*, cut through by the cautery, or controlled by pressure; resection or amputation is best done either by enucleation, by the cautery, or with the knife or scissors,—preferably, perhaps, in the order named; the mortality thus far has only been about 10 per cent. W. W. Keen (Boston Med. and Surg. Jour., Apr. 28, '92).

Removal of the liver in the frog does not involve an immediately fatal tissue, as in the case in mammals. Roger (La Sem. Méd., June 15, '92).

Case of successful removal of an adenoma connected by a thick pedicle with the lower surface of the liver. Von Bergmann (Brit. Med. Jour., May 27, '93).

Portions of the liver removed by operation speedily replaced and parts renewed perform their function normally; surgeon justified in removing, when necessary, even large portions. Von Bergmann (Archiv f. klin. Chir., B. 46, H. 2, '95).

In operations on the liver ligation of the mass of the liver, slowly and firmly drawn tight, closes the lumen of the vessels and thus prevents hæmorrhage. After chloroform the peritoneum is opened and the lobe of the liver drawn out through the wound. A row of ligatures is then made through the liver, with a blunt needle and a double silk thread, the entire length of the piece to be removed. The needle is passed through the substance of the liver several times, a few centimetres apart. The nearest threads in the different holes are tied together. When these ligatures are drawn

tight, the piece to be resected in front or back of them is removed. Compresses of gauze should be applied to control hæmorrhage of the parenchyma. After ablation the hepatic stump is sutured to the end of the abdominal wound, or the great omentum can be sutured to the cut surface of the liver, or the stump can be put back into the abdominal cavity and the walls closed with a suture in three stages, after dressing with collodion gauze.

The most convenient cutaneous incision is parallel to the arch of the false ribs, one or two finger-breadths below, ten to fifteen centimetres in length, starting at the right parasternal line for the right lobe, and at the median line, swerving to the left, for the left lobe. Kousnetzoff and Pensky (Rev. de Chir., Dec., '96).

As a means of hæmostasis, the temporary digital compression of the pedicle of the liver is proposed. The method of procedure is as follows: The left index finger is introduced through the foramen of Winslow and compression by the thumb of all the structures of the pedicle. Tuffier (Gaz. Hebdom. de Méd. et de Chir., Jan. 28, '97).

Hæmorrhage forms the serious danger which makes the extirpation of malignant tumors of the liver very perilous. Routier (Univ. Med. Jour., Feb., '97).

In resection of the liver it is recommended to apply to the liver around the portion to be removed a series of interlocked ligatures of thick silk. Each individual ligature, after being crossed with its fellow to the right and left, is slowly and steadily tied with such firmness that the liver-parenchyma is cut, but the vessels are retained undivided in the loop. When the whole series of ligatures are tied then the vessels are to be severed by the knife or scissors. It is of importance while transfixing the liver to use little force, and when any slight obstacle to the passage of the instrument is encountered, to manipulate the needle from side to side, and so gently guide it past the obstruction.

The points of transfixion ought to be about one centimetre apart. In experiments on dogs no difficulty has ever been met with, and the wound in the liver has

never bled in the slightest degree, either primarily or secondarily.

It might be well in excising portions of the liver to make the wound wedge-shaped, so that, hæmostasis having been obtained by ligatures, the wound might be made less extensive by means of sutures passed from side to side. M. Auvray (*Revue de Chir.*, Apr., '97).

The best procedure in treating liver-wounds after removal of tumors is to use a rubber tube for a tourniquet, if necessary to tie all large vessels separately, using pressure for the oozing; to close the liver as much as possible with sutures; to drop the stump and to surround it completely with sterile gauze, packing iodoform gauze against the liver-wounds, and leave the abdominal wound sufficiently open to facilitate dressing the liver-wound. Elliott (*Annals of Surg.*, July, '97).

Successful extirpation of a large cavernous angioma of the liver. Its origin was from the lower surface of the left lobe by a broad attachment. Pfannenstiel (*Allg. Med. Central-Zeit.*, Feb. 19, '98).

Analysis of 76 cases of resection of the liver for hepatic neoplasms. The termination in the case of 2 patients was uncertain; of the remaining 74, 63 recovered, the operative mortality thus being 14.9 per cent. Shock, hæmorrhage, and exhaustion caused death in 8 instances; septicæmia in 2, and pulmonary embolism in 1. Four-fifths of the patients were females, this proportion being attributed to tight lacing. Echinococcic and hydatid cysts were found in 20 instances; carcinoma in 17; syphiloma in 2; adenoma in 7; sarcoma in 5, and rarer forms of new growth in single instances. An early exploratory cœliotomy advocated in every case. Keen (*Annals of Surgery*, Sept., '99).

Hæmostasis of the liver. Experiments on dogs showed that in wounds 4 by 3 centimetres, plugging alone was sufficient. In resections (involving 30 to 40 grammes) plugging alone was not always safe, but combined with isolated ligature of the vessel it was satisfactory. Digital compression of the hepatic hilum was

useful as a temporary measure. Tricomi (*Il Policlinico*, Sept. 15, '99).

Portions of liver-tissue of considerable size may be safely removed by previously rendering anæmic the part which it is intended to remove. For the support of the ligatures, living tissue from the same animal, preferably the fascia and peritoneum from the abdominal wall, is best suited. The intraperitoneal or the intraparietal method is preferable to the external method. Carl Beck (*Jour. Amer. Med. Assoc.*, April 26, 1902).

New method of exposing the liver through the posterior surface of the right lobe. The patient which the writer reports, was believed to have a tuberculous right kidney. There was pain on pressure in the lumbar region, which was believed to be due to the kidney. The latter was exposed from behind after resecting the twelfth rib and then pushed to one side after being freed from its attachments. The posterior aspect of the right lobe of the liver was thus exposed and on it was seen a tumor, which was removed. It proved to be a gumma and the patient made a good recovery under appropriate treatment. Although there may have been some doubt as to the propriety of surgical intervention in this case, still the advantage of reaching this region of the liver was shown. It is indispensable, however, that the pedicle of the kidney is sufficiently long to permit pushing the kidney to one side. J. Israel (*Deut. med. Wochen.*, Mar. 31, 1904).

Hydatid Cyst of the Liver.

Symptoms.—Small cysts cause no symptoms; they may be discovered at the autopsy. Cysts may reach considerable size without causing inconvenience and be discovered as a tumor-like enlargement accidentally. The liver enlarges irregularly and in time the cyst causes disturbance by pressing on some neighboring organ or part, interfering with its function. If in the dome of the liver it may displace the heart or lungs. It may press on the bile-passages,

jaundice resulting; or on the portal vein, causing ascites. If it presses on the vena cava it causes œdema of the legs. If superficial, the cyst may fluctuate to palpation, or, if tense, it may be felt as a hard solid mass. *Hydatid thrill* is sometimes obtained by placing one hand lightly on the cyst and tapping it gently with the fingers of the other hand. The thrill has been ascribed to the sudden impact of the daughter-cysts against each other and against the wall of the cyst; but thrill is sometimes obtained in cysts which contain only clear fluid.

Rupture of the cyst may occur. If it takes place into any of the serous cavities inflammation results. The pleura suffers most frequently; perforation of the lung often follows, with pneumonia and the expectoration of cysts and hooklets. More often pus, blood, and bile-pigment are coughed up, such as occurs in gangrene or abscess of the lung secondary to liver-abscess.

The cyst may rupture into the stomach, as proved by the vomiting of cysts and hooklets; or into the intestine, with the appearance of these bodies in the fæces, as would occur also if rupture takes place into the bile-passages. Rupture may occur into the pelvis of the right kidney followed by the presence of the hooklets and cysts in the urine.

Case of hydatid disease of the liver, with perforation of one of the cysts into the stomach. Karmilow (*Laitopisj Chir. kago obschtschestwa*, No. 3, '92).

Hooklets are frequently absent from hydatid tumors. James Watson (*Lancet*, Dec. 3, '92).

Case of cyst in the liver containing 10 quarts of liquid. Microscope showed no traces of echinococcus and no bile-salts or pigment. There was no epithelial lining of the cyst. Boyer (*Amer. Jour. Med. Sci.*, May, '93).

Cases of hydatid cysts in which cyst opened through gall-bladder. Brjucha-

now (*Bolnit. Gaz. Botkina*, No. 2, '95); Medwedjewa (*Bolnit. Gaz. Botkina*, No. 2, '95).

Case of hydatid cysts in which cyst opened into bladder. Henczynski (*Münch. med. Woch.*, Mar. 26, '95).

Case of ileus due to hydatid cyst of the liver. Reichold (*Münch. med. Woch.*, Apr. 27, '97).

Apart from such accidents, the symptoms may consist only of trifling discomfort in the hepatic region.

Rupture of the cyst is often followed by severe urticaria; it has been attributed to a toxic material in the fluid. It may also follow aspiration of the cyst.

Diagnosis.—This is rarely possible before the cyst has attained considerable dimensions; then the irregular enlargement of the liver for a long period, with the preservation of health, indicates hydatid disease. It may be necessary to aspirate the cyst, and, if hooklets are found in the fluid, the diagnosis is confirmed. A fluctuating tumor in the epigastrium is suggestive; it may give fremitus and be within easy reach of the aspirator-needle. Abscess of the liver is differentiated by the absence of symptoms of suppuration. It will not be possible to distinguish a suppurating hydatid cyst unless the hooklets be found in the fluid. Cancer has been closely simulated by suppurating cyst. The clinical history usually serves to differentiate it. Dilated gall-bladder and hydronephrosis have been mistaken for hydatid cyst. A more common error is the mistaking of a cyst of the dome of the liver for right pleural effusion. Subdiaphragmatic abscess, and purulent pleurisy secondary to rupture of a cyst are conditions difficult or impossible to distinguish unless the hooklets are found in the fluid.

In hydatid cysts of the liver a preliminary puncture with the aspirator should always be performed, as it estab-

lishes the diagnosis and may effect a cure. In subdiaphragmatic hepatic cysts the transpleural incision with costal resection at one and the same time should be the operation preferred. Ségond (Lancet, Apr. 14, '88).

Peculiar symptom observed in two cases of hydatid which is believed to be of great value in the diagnosis of impending or actual perforation of the cyst. It is a highly characteristic aromatic odor, resembling that of boiled plums. Eichhorst (Zeits. f. klin. Med., B. 17, Supplement H, '90).

A new physical sign for hydatid cysts consists in the development of a peculiar sound on combined auscultation and percussion. Rovighi (Policlinico, No. 11, '94).

Resounding sign described by Santini a valuable diagnostic point. Uniform in single cyst, varying when a number present. Fiaschi (Australasian Med. Gaz., Aug. 20, '95).

In diagnosis between echinococic cyst of the liver pointing upward and pleurisy with effusion the complete absence of the breath-sounds and the occurrence of pains beneath the shoulder-blade are significant points. In pleurisy the heart is pushed to the left, in hydatid cysts to the left and upward. Sometimes an elastic resistance may be felt and fluctuation occasionally occurs. Cardarelli (Giorn. Inter. delle Sci. Med., Feb. 29, '96).

The term hydatid is applied to the bladder-worms, which are the larval forms of the *Tania echinococcus*: the minute tape-worm of the dog family. When fully grown the parasite is not more than four millimetres, or one-sixth of an inch, long. It consists of four segments, of which the last alone has fully-formed sexual organs. It is very common in dogs of Iceland and Victoria (Australia); also in the Icelandic settlements in Manitoba (Canada), the dogs having been brought from Iceland. The ova of the echinococcus are expelled with the excrement and find their way into the alimentary canal of man by water

and green vegetables; also by direct contact with infested dogs, to the hair of which ova adhere and may be carried to the mouths of those who touch the dogs. The disease is rare in Canada and the United States, as well as in European countries, because the dogs are rarely infested, else, of necessity, hydatids would be of frequent occurrence among all classes, irrespective of habits as to cleanliness.

Morbid Anatomy.—The ovum, having entered the human stomach, loses its covering by digestion, setting free the larva, which, by its hooklets, burrows through the intestinal wall. Some of them meet with and enter a branch of the portal vein and are carried to the liver, where they lose their hooklets, and their cystic development begins. The cyst contains a clear non-albuminous fluid inclosed in a capsule of two layers. There is an outer, thick, homogeneous, laminated, elastic membrane which coils upon itself wherever cut and if withdrawn displays a tremulous motion. This is the *ectocyst* of Huxley. Within and closely in contact to this lies the *endocyst*: a delicate, thin, soft, granulated membrane, forming the vital part of the bladder-worm. Outside the capsule there is usually a thick investment derived from the tissues of the infested organ. After the cyst has attained considerable size buds are produced from the inner membrane which gradually develop into cysts having the two walls identical with the parent-cyst. From these daughter-cysts similar buds develop and from a tertiary series—the granddaughter-cysts, and so on indefinitely. In time each of these cysts severs its attachment to the parent and becomes independent. From the inner membrane or endocyst of all these cysts buds arise and become transformed into

scolices, or echinococcic heads, presenting a circle of hooklets and form sucking disks. Each of these, transferred to the intestine of a dog, may develop into a tape-worm. The exact manner of the development of these buds is in dispute. It is thus apparent that there is a striking contrast between the development of this parasite and of the *Tænia solium*. The ovum of the latter develops into only one larva capable of producing only one tape-worm, while the ovum of the *Tænia echinococcus* produces a larva capable of multiplying itself indefinitely, so that from it an innumerable number of tape-worms may result.

The hydatid cyst is usually single, the daughter-cysts being in the cavity of the mother-cyst, which may be of enormous size, filling the abdomen and pushing the diaphragm high into the thorax. The liver-tissue is atrophied in proportion to the size of the cyst; that is, the pressure to which it is subjected. The parasite may die. Then the fluid becomes absorbed, the capsule shrivels, and within its remains are found fat-drops, cholesterol crystals, and hooklets. The capsule may become inflamed and an abscess result.

In lower animals the cyst may be multiple, the daughter-cysts developing outward from the mother-cyst: exogenous.

A third form is multilocular. In this the daughter-cysts are surrounded by fibrous tissue and all become consolidated into a multilocular mass resembling a colloid cancer, for which it was formerly mistaken.

Prognosis.—Hydatid cyst of the liver is a serious disease, proving fatal in about 25 per cent. of the cases. The course of the disease is chronic, sometimes lasting as long as thirty years. Recovery may follow death of the echino-

coccus, which occurs occasionally, possibly from escape of bile or blood into the cyst. As a rule, the cyst ruptures on account of its continued increase in size. The rupture may take place into the peritoneal cavity and is usually fatal from shock; the fluid, being sterile, does not cause peritonitis. If inflammatory adhesions to the colon, stomach, small intestine, or right kidney have preceded the rupture, the cyst may rupture into one of these organs, with discharge of the fluid by vomiting, diarrhœa, or with the urine. If the cyst is situated in the dome of the liver it may rupture into the pleura or pericardium. The latter is fatal, but recovery may follow discharge through a bronchus. Rupture may occur into the hepatic vein, or the vena cava and cause sudden death. The cyst may open into the bile-passages and recovery follow, although grave symptoms usually result from obstruction and secondary infection.

The most favorable result is by adhesion to the abdominal wall and perforation externally, usually near the umbilicus. The cyst frequently suppurates, pyogenic organisms gaining access to the cavity by the blood or bile, or from a neighboring inflammatory focus. As in abscess, the pus here also is said to be usually sterile.

Treatment.—Operation alone offers hope of relief, and brilliant results have followed such intervention. The simplest operation consists in aspiration, and is frequently successful. If not successful, injection of antiseptic fluid should be resorted to. Various antiseptics have been recommended, the last of which is probably silver-nitrate solution (1 to 500). It is said to act by precipitating the chlorides and leading to the death of the parasite.

Statistics of abdominal section for hydatid of the liver show extremely favorable results,—68 cases, with 7 deaths,—within a fraction of 90 per cent. of recoveries. The method of operation by two stages, producing peritoneal adhesion by incision and packing with carbolyzed gauze, showed a mortality of a fraction over 19 per cent.; the operation by caustics gave a mortality of 33.68 per cent., while that by *canule à demeure* was 26.66 per cent. Thoracic incisions for hydatids of the liver occupying the convexity of the organ show a high rate of mortality. Where an hydatid cyst of the liver has ruptured into the pleura, free incision into the pleural cavity appears to be the only treatment which holds out a fair promise of success. Thomas (Brit. Med. Jour., Sept. 28, '89).

Aspiration performed only in cases of simple cysts of the liver without daughter-progeny, and in those that have not suppurated. Reference made to Davies Thomas's statistics,—411 tapping-operations on liver-cysts: 73 died, 5 not relieved, 92 failed to cure, 68 relieved, 163 reputed cured, and 10 cases result unknown. Alexander H. Ferguson (Annual, '94).

Method of Baccelli, which consists of injection into the cyst of 20 cubic centimetres of distilled water containing 0.02 gramme of corrosive sublimate after the withdrawal of 30 cubic centimetres of the liquid, should be practiced in the treatment of echinococcic cysts before a formal operation is undertaken. Stefanile (Riforma Med., No. 76, '96).

The true surgical treatment of hydatid cysts of the liver consists in direct incision made by the anterior abdominal route, by the transpleural route, or by the lumbar incision. Median or lateral laparotomy should be reserved for antero-inferior or antero-superior cysts. The transpleural route with resection of the ribs is the best way of reaching sub-diaphragmatic cysts which are deeply placed. Lumbar incision allows the surgeon to reach cysts in the posterior and lower part of the liver. Bolognesi (Bull. Gén. de Thér., Mar. 30, '96).

In hydatids of the liver: an incision over the most prominent part of the mass

should be made, if a mass can be detected; but, if no tumor is obvious, the guide to incision is the area of hardening and of dullness on percussion. They should be produced by suturing the peritoneum around the mass. The aspirator is used to prove diagnosis, always bearing in mind the possibility that typical fluid will not appear, as it may be too thick to enter the needle. When it has been found necessary to produce adhesions artificially the surgeon waits for several days before opening the cyst. The opening made in the cyst-wall should be of sufficient size to admit a large-sized drainage-tube. The dressing must be conducted with the strictest antiseptic care. For the first week after operation the cyst-cavity should be washed out with sterile water, after this with carbolic solution, iodine solution, or any of the antiseptic solutions. J. Frank (Amer. Jour. Med. Sci., Oct., '96).

In resection of the liver for echinococcus stress laid on the value of a preliminary ligature passed through the whole substance of the liver, so as to keep the organ well in the abdominal wound. Paleroni (Gazz. degli Osped., Aug. 7, '98).

Case of hydatid cyst of the liver and a case of abscess of the liver, both of which were treated by transpleural drainage, a portion of the ninth rib having been removed. In order to shut off the pleural cavity the cyst in the first patient was sutured to the tissues of the chest-wall, and in the second patient the same result was achieved by the suturing of the viscera to the parietal layer of the pleura. Both patients recovered. Newbolt (Brit. Med. Jour., Jan. 24, 1903).

Free incision and drainage are being resorted to more frequently of late, and with results that justify such radical means.

Electrolysis and potassium iodide have been successful in a few cases.

Amyloid Liver.

Symptoms.—There are no characteristic symptoms of amyloid liver. The patient presents the symptoms of the pri-

mary disease to which the amyloid change is due. He is pale, cachectic, and later may be dropsical. There is no jaundice or bile-pigment in the urine. Bile is secreted and flows into the intestines, coloring the contents. There is disturbance of digestion and often diarrhœa, on account of the amyloid deposit in the intestine. The urine is usually copious, pale, of low specific gravity, and contains much albumin on account of the amyloid disease of the kidneys.

On physical examination the liver is found large, firm, smooth, and not tender. Its lower edge is usually rounded, but sometimes sharp, and not rarely as low as the iliac crest. There are no signs of portal obstruction. The spleen may be large, on account, chiefly, of the amyloid change in it.

Course and Duration.—The general condition grows gradually worse, the surface becomes an earthy pallor, which, some believe, is characteristic, and the patient dies from exhaustion, if not cut off by an intercurrent affection or a “terminal infection.”

The duration of the disease is usually several years, although occasional cases run their course in a few months.

Diagnosis.—This is usually easy from the associated conditions. The occurrence of progressive enlargement of the liver in a case of long-standing suppuration, especially of a tuberculous or syphilitic character, renders the diagnosis almost certain. The co-existence of degeneration of the kidneys, spleen, and intestines adds to the certainty of the diagnosis.

Etiology.—In amyloid liver a deposit of waxy material takes place in the blood-vessels and interstitial tissue of the liver. It occurs as part of a general degeneration in certain constitutional conditions of which prolonged tuberculous

suppurations of the bones, lungs, and urinary tract are the most frequent. Next to these, syphilitic suppurations are the most common causes; but the amyloid change may occur in syphilis without suppuration. It is also occasionally found in rickets, Bright’s disease, leukæmia, malignant disease, and in protracted convulsions from infectious fevers.

Morbid Anatomy.—In advanced stages the liver is greatly and uniformly enlarged. Its size may be doubled and its weight more than trebled. The surface is smooth, firm, and of a slightly glistening yellowish-gray color. On section the surface has an anæmic, waxy appearance, is semitranslucent in thin sections, and the infiltrated areas stain a rich mahogany-brown on the application of a dilute solution of iodine, while the normal parts become a light yellow.

The morbid change usually affects the capillaries in the middle zone of the hepatic lobules first, and later the interlobular vessels and connective tissue. In the capillaries “the amyloid substance lies between the endothelium and the liver-cells, and the latter atrophy apparently because of the pressure which the amyloid substance exerts. Some of the cells show fatty and albuminous degeneration” (Thoma).

Similar changes are usually found in the spleen, kidneys, and mucous membranes of the intestines.

Amyloid disease of the liver is localized to the tiny blood-vessels at first, to the walls of the trabecular capillaries; later, of the intralobular capillaries. Amyloid matter forms a solid cylinder of the former arterial walls, with almost total obliteration of the lumen of the vessel. When the liver-cells show changes, these begin near the affected capillaries. Thus it is that specimens may show three layers in a lobule—a narrow periphery of fatty degeneration,

normal liver-cells in the centre, and between them the intermediate layer showing the changes of amyloid degeneration. The cell-granulations are gradually replaced by this material. Others claim that the hepatic cells never become amyloid, the changes found in them being due to mechanical forces alone. The author gives a detailed description of the histological findings in two cases of amyloid disease of the liver. His investigations show that amyloid degeneration is not seen in the liver-cells at all, the changes there found being those of compression, deformity, and atrophy, always secondary and mechanical. B. Auché (*Jour. de Méd. de Bordeaux*, Sept. 15, 1901).

Prognosis.—The prognosis is bad. Many, however, claim that a cure is possible in the initial stage if the cause is removed.

Treatment.—There is no effective remedy for the disease known; therefore the treatment should be prophylactic.

Tuberculous disease of bones should be treated surgically and cured as soon as possible, as should also chronic suppurations of all kinds. Syphilis should be vigorously treated. The patient should be nourished and the strength maintained as well as possible.

Fatty Liver.

Fatty liver occurs under two forms: fatty infiltration and fatty degeneration. The former represents a normal condition, since liver-cells always contain some minute globules of fat. In this form the particles of fat penetrate the liver-cells, where they coalesce into growing droplets and push aside the cell-protoplasm and often destroy it by interfering with its nutrition.

In fatty degeneration there is a conversion of the protoplasm itself of the cell into fat probably by the action of some toxic agents, such as phosphorus.

Fatty Infiltration.

Symptoms.—There are no distinctive

symptoms. The liver may, if large, be felt to be smooth, soft, not tender, and with rounded edges. There is no jaundice. Addison long ago drew attention to a semitransparent, pale, smooth, soft skin, feeling like softest satin, occurring in fatty liver. He considered it almost pathognomonic. And Hebra noticed a similar condition of skin in habitual spirit-drinkers, and in them fatty liver is common.

Diagnosis.—The fatty liver can usually be recognized by its soft, smooth character and its occurring in the obese or the emaciated. The large amyloid liver is distinguished by being firm, larger, and by the history of the cause and the evidence of renal disease.

Etiology.—The conditions under which fatty infiltration occurs may be divided into two main classes, strikingly in contrast with one and other. In one class the fatty liver results from dietetic errors, from eating an oversupply of rich food, and as a part of general obesity, chiefly in persons of sedentary habits. The blood is overcharged with fat, of which much is stored in the hepatic cells.

The other class consists of cachectic cases, of which pulmonary phthisis furnishes the greater number. In these, on account of the low powers of oxidation, even the small amount of food that is taken is not properly oxidized and much of it is converted into fat and deposited in the liver-cells.

The autopsy reports at the New York Foundling Hospital studied with special reference to the condition of the liver. These consisted of some 500 cases, and showed that cirrhosis of the liver is very rare in infancy, as is also the condition of waxy liver. A careful study of fatty livers gives, in contradistinction to the ordinary statements given in text-books, the following conclusions: (1) fatty livers occur very frequently in the infants and children that come to autopsy

at the Foundling Hospital,—in about 41 per cent. of all cases; (2) the condition of nutrition of the child apparently has no connection with the fatty condition of the liver, the condition of nourishment in the cases having fatty livers averaging about the same as in the whole number of cases; (3) fatty livers occur rarely in the chronic wasting diseases, such as marasmus, malnutrition, or rachitis and syphilis, unless such condition be complicated by an acute disease; (4) with tuberculosis fatty livers occur not more often than with other conditions; (5) fatty livers occur most often with acute meningitis, gastro-intestinal disorders, measles, and diphtheria. R. G. Freeman (Boston Med. and Surg. Jour., Oct. 19, '99).

Morbid Anatomy.—The liver is large, smooth, and soft. It may weigh ten or twelve pounds. The edge is thick and rounded. The deposit of fat begins in the cells at the periphery of the lobule, and in time distends them. It can be extracted from the cell with ether, leaving the cell shrunk.

The specific gravity of the liver is reduced, so that the whole organ floats when placed in water.

Prognosis.—This will depend on the cause. If the condition that leads to the deposit of fat in the liver is relieved the further deposit of fat will cease and the hepatic cells will gradually be restored to their normal condition.

Treatment.—Treatment should, therefore, be directed to the cause of the condition. In the obese there should be a careful regulation of diet, with a view to lessening the formation of fat while sustaining the strength. Habits of early rising and active exercise should be encouraged, care being taken not to induce overfatigue, especially if the heart shows signs of weakness, as it often does from fatty infiltration or degeneration. Water should be freely taken on an empty stomach, and occasional purging resorted to.

Little, if any, alcoholic stimulants, especially beer, should be allowed. If sufficient active exercise cannot be taken, massage and resistance movements will, to a great extent, supply its place.

In the anæmic form of fatty liver, such as occurs in pulmonary phthisis, the treatment should aim at improving the general condition without regard to the liver.

Fatty Degeneration.—This results from poisoning of some form, as in acute yellow atrophy, in which the liver-changes are typical of fatty degeneration.

Inflammation of the Bile-passages and Gall-bladder (Angiocholitis or Cholangitis and Cholecystitis).

Definition.—This consists in an inflammation of the biliary tract. It may affect the common bile-duct and all its branches or any part of them, the cystic duct, or the gall-bladder.

Symptoms.—Since catarrhal cholangitis nearly always follows gastro-enteric catarrh, the usual acute dyspeptic symptoms precede those due to the disease of the bile-ducts; such as anorexia, belching of gas, epigastric distension, nausea, vomiting, and constipation. These symptoms may, however, be very mild, or most of them may be absent, and jaundice be the first symptom noticed. The jaundice deepens rapidly, but is always of a bright-yellow tint, never the green or bronzed hue of that due to malignant disease. The stools are clay-colored and the urine contains bile-pigment. The temperature may be slightly elevated. The pulse is usually normal, but may be slow, being only 40 or 50 to the minute. A dull, heavy, sleepy condition may be present. The liver is sometimes enlarged and palpable below the costal margin.

If the catarrhal inflammation is confined to the gall-bladder the cystic duct

usually becomes obstructed by pressure of the bladder-contents on the outlet. No jaundice occurs, or any of the foregoing symptoms, except a sense of pressure and sensitiveness at the seat of the gall-bladder. When distended, it may, if the abdominal wall is lax and not too thick, be felt as a pear-shaped mass adherent to the liver and moving with it.

In suppurative cholangitis the symptoms are usually severe, but may be latent, especially if the disease occurs in the course of an acute infectious disease. There is, in most cases, a previous history of gall-stones. The patient usually suffers from irregularly recurring chills, with fever and sweating, the temperature rising to 104° F. or more. There is swelling and tenderness of the liver. Jaundice is always present, but more variable than in the catarrhal variety; it may be intense. Leucocytosis occurs and is suggestive of the condition. Later the case presents the appearance of a well-marked general pyæmia with emaciation and weakness.

In chronic catarrhal angiocholitis the symptoms may be very characteristic. The jaundice may vary if the degree of obstruction alters, as it often does when a gall-stone is situated in the diverticulum of Vater, where it may act as a "ball-valve," producing complete obstruction as it moves into the outlet of the duct, and, again, allowing bile to pass as it moves back into the diverticulum. In chronic angiocholitis there are often recurrent attacks of fever with chills and sweating, the so-called intermittent hepatic fever. Such cases may have a history extending through some years. It is probably to this class belong the cases regarded as suppurative cholangitis with a prolonged history and ultimately terminating in recovery.

Diagnosis.—In acute catarrhal cho-

langitis the diagnosis is usually easily made from the digestive disturbance and gradual onset of the jaundice. Gall-stones are excluded by the absence of colic and the fact that the jaundice is not of sudden development. In catarrhal cholecystitis there is enlargement of the gall-bladder, which may be palpable as a pyriform tumor adherent to the liver and rising and falling with respiration. Not infrequently a tongue-like lobe of the liver is mistaken for a distended gall-bladder. So may also a movable kidney; it is usually more easily displaced, and is not attached to the liver. Instead of being smooth, rounded, and elastic, the distended gall-bladder may, from inflammatory thickening, appear more like a solid tumor and be mistaken for cancer in this situation, but cancer is usually associated with jaundice and cachexia. Echinococcic cysts have also to be excluded; aspiration may be necessary to do so. The history and shape of the tumor may be sufficient to differentiate between the two conditions.

The diagnosis of suppurative cholangitis is to be made by a history of gall-stones, the occurrence of a septic condition with enlargement and tenderness of the liver, and the existence of leucocytosis. There is progressive loss of flesh and strength. The duration rarely exceeds a few weeks, the cases lasting months and ultimately recovering being most probably cases of chronic catarrhal cholangitis due to obstruction, and causing intermittent hepatic fever.

Etiology.—Inflammation of the bile-passages usually results from extension of an inflammatory process from the duodenum, and is, in the majority of cases, associated with gall-stones. The duodenal catarrh that precedes the cholangitis usually follows acute indigestion. The young are most susceptible to it,

but it may occur at any age. It occurs also as the result of exposure to cold, chills, malaria, typhoid fever, pneumonia, and in the course of Bright's disease, chronic heart disease, emphysema, etc. It may occur in the course of any organic disease of the liver, as inflammation, cancer, and hydatids. Chronic catarrhal cholangitis may possibly be a sequel to the acute. It is always due to obstruction of the common bile-duct from gall-stones, stricture, pressure from without, etc. The obstruction may be complete, in which case the ducts are greatly dilated and filled with clear, watery fluid similar to that of dropsy of the gall-bladder. If the obstruction is incomplete, there is less dilatation of the ducts, and, as some bile filters through, their contents are bile-stained and turbid. The gall-bladder is not much dilated in these cases, obstruction of the cystic duct being necessary to cause great dilatation of it. Gall-stones are usually found in it.

Suppurative cholangitis is usually associated with gall-stones, less frequently with echinococci and round worms. The mucosa, injured by such foreign bodies, becomes more susceptible to invasion by pyogenic organisms, and these are present normally in the intestines and in the lowest part of the common bile-duct.

Morbid Anatomy.—In acute catarrhal cholangitis the lower part of the common bile-duct is usually chiefly, and may be the only part, affected. The inflammation may extend to its larger branches. Post-mortem evidences are slight, as redness and swelling disappear after death. A plug of inspissated mucus may fill the diverticulum of Vater and completely obstruct the flow of bile. The gall-bladder, when affected, contains a more or less viscid mucous secretion; if there is obstruction of the cystic duct, the

bladder becomes distended with fluid, of which it may contain one or more pints, usually thin and without bile. The walls of the gall-bladder are thin and shining; but, if the obstruction persist, they may become much thickened.

In suppurative angiocholitis the common duct becomes greatly dilated and its walls much thickened. Similar changes occur in the gall-bladder. Both are distended with pus. Ulceration may occur and perforation into the stomach, colon, or duodenum, or even into the urinary or respiratory tract. The intrahepatic bile-ducts may be distended with pus,—which is usually bile-stained. The suppurative process may extend to the hepatic substance, resulting in abscess-formation, or to the portal vein, and pylephlebitis result.

The bacteria present in these inflammatory processes are very various. The bacillus coli communis probably plays the most important part, but staphylococci and streptococci are also common, as they are all present in the duodenum in health. The pneumococcus and the typhoid bacillus may be the active agents.

Treatment.—This consists in measures to relieve the gastro-duodenal catarrh. Plenty of liquids should be taken, especially the alkaline mineral waters. The bowels should be moved freely, but not immoderately, by the use of calomel followed by salines, such as Carlsbad salts, phosphate of soda, etc. Bicarbonate of soda, with bismuth, may prove useful for the gastric disturbance. Such antiseptics as resorcin, guaiacol-carbonate, and salicylate of bismuth are useful. A large cold, rectal enema may be given daily; it is said to stimulate contraction of the gall-bladder and ducts and thus promote expulsion of the mucus that is obstructing the escape of bile. The water is to

be retained so as to furnish more liquid for excretion, but it cannot effect that object better than water taken by the stomach.

Light liquid diet only should be given, as it is easy of digestion and less apt to ferment.

Tumors of the Biliary Tract.

Cancer.

ETIOLOGY.—Cancer may occur as a primary disease of the gall-bladder and of the bile-ducts or may be secondary to cancer of the liver, stomach, pancreas, or peritoneum.

Primary cancer of the gall-bladder affects females much oftener than males—in the ratio of 3 or 4 to 1. The bile-ducts are affected about equally in the two sexes. The disease occurs usually from forty to seventy, but occasional cases are met with in early life and at advanced age.

Gall-stones are present in practically all cases of cancer of the gall-bladder. The relationship between the two conditions is in dispute. Some regard the cancer as developing in the glands of the mucosa on account of the irritation by the calculi; while others look upon them as formed subsequently to the commencement of the cancer. The greater frequency of occurrence of gall-stones in females gives support to the view that their irritation frequently excites the development of cancer.

Attention called to the frequency with which cancer and biliary lithiasis are associated. Of 44 cases of mammary cancer in females, gall-stones were found in 16 per cent.: a ratio twice as high as that stated to hold for women dead of causes other than cancer. Williams (Brit. Med. Jour., Aug. 26, '93).

The disease usually begins at the fundus of the gall-bladder, and at either extremity of the common bile-duct.

Cancer of the Bile-ducts.

SYMPTOMS.—It rarely forms a tumor that can be felt through the abdominal wall. The jaundice usually occurs early, and is intense and persistent. The stools are persistently clay colored. A fatal termination usually follows in three or four months, from cholæmia. It may be the cause of cholangitis with intermittent hepatic fever or there may be suppurative cholangitis.

DIAGNOSIS.—It is practically impossible to make a positive diagnosis without an exploratory operation. The persistent intense jaundice is suggestive, and may, in some cases, render the diagnosis extremely probable, especially in the absence of biliary colic.

MORBID ANATOMY.—The cancer usually develops in the circumference of the duct as an infiltration of the submucous tissue. The surface of the deposit may be smooth or ulcerated. They occur most frequently in the diverticulum of Vater and may extend to the duodenal papilla.

Cancer of the Gall-bladder.

SYMPTOMS AND SIGNS.—Not rarely the attention is first arrested by the accidental discovery of a smooth, firm, egg-shaped swelling below the costal margin. It is fixed to the liver and moves with it in respiration. There is usually a sense of discomfort and later often of irregular pain in the neighborhood of the mass. The pain is rarely persistent or severe, and may disappear altogether. It is usually worse at night and may extend around to the back. Later, as the tumor enlarges, it becomes less defined, and nodules often appear on its surface. If dissemination has occurred, nodules may be felt on the liver and in the peritoneum. Ascites may result from the peritoneal affection or from pressure by diseased lymph-glands on the portal vein

in the hilum of the liver. Jaundice occurs in probably not more than half of the cases; when it occurs it is a late symptom and depends on pressure on the bile-ducts in the hilum.

There is usually early general failure of health. In the later stages there is marked cachexia, and loss of flesh and strength, with, not infrequently, mental weakness and a prolonged period of sub-delirium. Adhesions to the intestines may give rise to symptoms of partial or complete obstruction.

The course is usually rapid, death occurring in a few months after the appearance of the tumor.

DIAGNOSIS.—The presence of a tumor and the progressive character of the local and general symptoms of the disease usually suffice for a diagnosis. In the absence of a tumor the diagnosis is difficult and may be impossible, as it may be also to distinguish a tumor formed by matted intestine from local peritonitis from a tumor of the gall-bladder. Even incision and exploration not rarely fail to clear up the difficulty.

Tumors of the pylorus, of the transverse colon, of the kidney, and of the suprarenal gland may simulate tumor of the gall-bladder.

MORBID ANATOMY.—The cancer may begin at the fundus or near the cystic duct, but often the walls of the gall-bladder are found uniformly thickened. The diseased gall-bladder may form a large, smooth or nodular mass adherent to the liver and to the intestines, and in the centre of the mass a considerable cavity filled with opaque gray fluid containing much flocculent material and several gall-stones. The cancer is usually a cylindrical epithelioma, but it varies much. It may extend into the liver directly or by way of the portal fissure, where it may affect the portal

vein and give rise to multiple deposits in the liver. The lymph-glands in the hilum of the liver are usually affected.

TREATMENT.—Symptomatic treatment is usually all that can be carried out. If the disease is recognized early before it has affected neighboring structures cholecystectomy may be practicable. Mayo Robson reports such a case in which he removed a large portion of the right lobe of the liver with the gall-bladder. The patient made a good recovery. Other similar cases have been lately reported.

Gall-stones are the most important etiological factors in malignant disease of the gall-bladder; he advises early operation, other things being equal, on active gall-stones, as nearly all the mortality-giving complications are the result of delay. Out of two hundred and fifty uncomplicated gall-stone operations, the mortality was less than 1 per cent. Primary cancer, as a rule, gives a hard tumor in the region of the gall-bladder, which is tender to touch, and, unless there is a peritoneal involvement, rigidity of the overlying muscle is not marked. It has been stated that at least one-half of the cases of jaundice diagnosticated as due to gall-stones are caused by cancer or complicated with it. William J. Mayo (Medical News, Dec. 13, 1902).

Other tumors of the bile-ducts are rare. Fibromata have been met with. Adenomatata occur occasionally. I met with one of the diverticulum of the common duct in a man aged 50 years. A gradually-increasing jaundice was the first symptom. Later suppurative cholangitis occurred, with chills, high fever, and tender liver. At the autopsy the mass in the duct was found to act like a ball-valve, obstructing the discharge of bile.

Acute Empyema of the Gall-bladder (Acute Infectious Cholecystitis; Acute Phlegmonous Cholecystitis).

Symptoms.—The onset is usually sudden, with pain in the right side of the

abdomen in its upper part, but, as in appendicitis, the pain may be general over the abdomen. Nausea, vomiting; a rapid, feeble pulse; thoracic breathing, rise of temperature, prostration, distension, and tenderness of the abdomen are the chief symptoms. In the cases in which the disease is circumscribed local tenderness soon becomes more marked. Jaundice is not usually present. Intestinal symptoms may be marked and not infrequently lead to a diagnosis of acute intestinal obstruction.

Diagnosis.—This is often impossible, especially in the fulminating cases. It is most often confounded with gangrenous appendicitis. In the less severe cases the signs of local disease—as pain, tenderness, signs of exudation, abdominal tension, etc.—may be sufficient to distinguish between the two diseases, unless the appendix is situated abnormally high.

Perforation of the stomach, the duodenum, the colon, the gall-bladder, etc., usually causes greater collapse at first and less marked septic symptoms later.

Etiology.—Acute empyema of the gall-bladder is a rare disease. Cases have been reported from time to time during the last few years. In about 75 per cent. of cases it is associated with gall-stones. It is doubtless due to infection by bacteria which may gain access by way of the blood or the bile. The typhoid bacillus, the colon bacillus, the pneumococcus, and the staphylococcus are the organisms most frequently present. Quite a large number of cases have followed typhoid fever, in some instances months after convalescence.

A comparison has been drawn between the causation of this disease and of appendicitis, the gall-bladder affection being of less frequent occurrence on account of its ampler blood-supply.

Morbid Anatomy.—The gall-bladder is distended, but not large, not containing more than a few ounces of muco-pus. There is a strong tendency to gangrene, proportioned to the virulence of the infection and the tension of the organ. The course is rapid, usually within four or five days. Adhesions are early formed to the intestines, omentum, etc. Later, perforation may occur and abscess result, or an abscess may form without perforation. In the severe cases general peritoneal infection is liable to occur. The contents of the gall-bladder may be very foetid.

Treatment.—Acute empyema of the gall-bladder is so rapidly fatal that only prompt measures are successful. As in phlegmonous appendicitis, so here prompt surgical treatment is necessary. The real difficulty is in making the diagnosis. In the early stage care should be taken not to obscure the symptoms by the undue use of opium. The temporary measures should consist in absolute rest, hot applications, complete abstinence from food, water only being given by the mouth, and relief of symptoms as far as possible until the necessity for operation is established when the gall-bladder, if there is empyema or gangrene of it, should be incised and drained or removed. In milder cases, in which the disease is localized, it is probably wiser to delay operation until the disease has been well circumscribed by the inflammatory process, when incision and drainage may be carried out and gall-stones, if present, removed.

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LOBAR PNEUMONIA. See PNEUMONIA.

LOBELIA.—Lobelia is the dried leaves and tops of the *Lobelia inflata*, or Indian

tobacco, a weed indigenous to the United States, collected after a portion of the capsules have become inflated. It is a small herb, with alternate leaves, an erect hairy stem, with blue flowers in the axils of the leaves. The herb has a slightly-irritating odor, and a burning, tobacco-like taste. It contains a liquid alkaloid, lobeline, and an acid, lobelic acid; gum resin, fixed oil, lignin, salts, chlorophylle, and a volatile oil.

Preparation and Doses.—Lobelia, 1 to 10 grains. Extractum lobeliæ fluidum, 1 to 5 minims (10 to 30 minims—emetic). Tinctura lobeliæ, 8 to 15 minims (30 to 60 minims—emetic).

Physiological Action.—Excessive doses of lobelia give rise to nausea, violent vomiting, cold sweats, pallor, marked prostration, muscular weakness, and occasionally purging. If the drug is not, in part, vomited, all these symptoms increase in intensity and the patient falls into collapse, soon followed by death. These phenomena bear out the prevailing view that paralysis of the motor nerves is the predominant influence of the drug when taken in poisonous doses. Dresser found that lobelia and its alkaloid, lobeline, stimulated the anterior section of the spinal cord. In frogs lobeline causes loss of co-ordination and disturbances of respiration. Ott observed that there occurred at first an immediate fall of arterial pressure, then a rise: a result apparently ascribable to the asphyxia induced through the influence of the drug upon the respiratory centres. Further experiments showed, however, that the rise of pressure was, in part, due to peripheral vasomotor stimulation. In therapeutics, therefore, the cardinal points to be borne in mind are that the effects of lobelia are primarily exerted upon the respiratory centres, the effects

upon the vasomotor system and the circulation being secondary factors.

Lobeline is a respiratory poison, as warm-blooded animals succumb to paralysis of respiration. In dogs it produces loss of voluntary movements and a concomitant exaggeration of the reflexes. Later, it produces paralysis of motor nerves, like curara. As it paralyzes the cardiac branch of the pneumogastric nerves, it may be included under the nicotine group. Lobeline causes an acceleration of the respiratory movements, which is more persistent when the vagi are intact. Further, it augments the power of the respiratory muscles. Small doses suppress the inhibitory influence of the pneumogastriacs on the heart. While it stimulates the respiratory functions, it does not depress the system like hydrocyanic acid, and in energy it even surpasses aspidospermine. H. Dresser (*Arch. f. exper. Path. u. Pharm.*, B. 26, H. 3, 4, '90).

At first lobeline causes an increased secretion of the sudoriferous glands, these effects lasting from five to six minutes. This increase is followed by a decrease, which, although not so pronounced as that produced by atropine, lasts for several hours. P. Aubert (*Lyon Méd.*, Dec., '93).

Poisoning by Lobelia.—The symptoms of poisoning by lobelia or its alkaloid—lobeline—are much the same as those due to tobacco poisoning. Giddiness, faintness, trembling of the limbs, clammy sweats, frequent and prolonged vomiting accompanied by the most intense prostration, violent abdominal and œsophageal pains, with occasional purging. The pulse, at first weak, becomes almost imperceptible. The breathing becomes shallow and difficult. The vision is affected. Stupor is followed by coma or convulsions, more or less paralysis, collapse, and death by paralysis of the muscles of respiration. Vomiting is occasionally absent, and then the constitutional symptoms are accentuated, and death is apt to follow. One drachm of

the powdered leaves has proved fatal in about thirty-six hours. On post-mortem examination the brain was found congested and the gastric mucous membrane inflamed.

Treatment of Poisoning by Lobelia.—The treatment of poisoning by lobelia consists in washing out the stomach by means of the stomach-siphon. Solutions of tannic or gallic acid may be given followed by the hypodermic injections of stimulants: alcohol, ether, ammonia, and strychnine. The recumbent position should be maintained, and warmth applied to the extremities. Opium given in full doses will relieve the pain, and later in moderate doses will control the vomiting.

Therapeutics.—Lobelia is chiefly used as an antispasmodic for the relief of asthma of the gastric or bronchial form. If the asthma is due to, or associated with, cardiac disease, lobelia should not be used. The drug should be taken in doses of $\frac{1}{2}$ to 1 drachm of the tincture at the beginning of the attack, or in 10-drop doses every quarter of an hour until nausea appears or relief is obtained. A feeble heart contra-indicates its use. Children are more tolerant of the drug than adults. Other spasmodic affections have been treated with lobelia,—pertussis, chorea, epilepsy, convulsions, and tetanus,—but other remedies equally efficacious and less dangerous are to be preferred.

In bronchial cough with scanty expectoration and bronchial spasm, it is sometimes useful as a depressing expectorant.

Habitual constipation due to intestinal atony and deficient secretion is often relieved by 10-minim doses of the tincture, given at bed-time. Its value is enhanced by combining it with cascara sagrada. Lobelia in infusion (1 ounce to the pint) is useful as a lotion in the treatment of

the dermatitis due to poison-ivy (*Rhus toxicodendron*). Lobelia should not be employed as an emetic, as it produces too much nausea and depression. When so used it has caused death. Lobeline has been used in the treatment of spasmodic asthma. Nunes claims that it is free from nauseant or irritant properties and can be used hypodermically in doses of $\frac{1}{6}$ to $\frac{5}{6}$ grain for children and 1 to 6 grains for adults. Nunes claims a cure in eight cases of tetanus by the use of lobeline.

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LOCKJAW. See TETANUS.

LOCOMOTOR ATAXIA.

Synonyms.—Posterior spinal sclerosis; tabes dorsalis.

Definition.—An organic disease of the periphoro-central sensory nervous system characterized symptomatically by incoordination, sensory and trophic disturbances; affections of special nerves, the optic and ocular particularly; and involvement of the sphincters.

Varieties.—In its classical form the symptom-complex in posterior spinal sclerosis is exceedingly constant. There are variations in the clinico-pathological picture, however, which justify a classification into at least three types: the common, or *typical*; the anomalous, or *atypical*; and the *complicated*. In typical cases the symptoms point to a primary disease of the sensory neurons of certain areas of the lower dorsal and lumbar cord (common type). Occasionally, though rarely, the primary invasion is of the upper or cervical cord (cervical or superior tabes), and in still others the initial symptom may be an optic atrophy (amaurotic tabes, initial optic-atrophy type). The predominance and persist-

ence of pain in certain cases has served as the basis for a so-called neuralgic type (tabes dolorosa, Remak), while the early development of general or pseudoparaplegic muscular weakness, which becomes rapidly prominent, affords a basis for the recognition of the so-called paralytic type. True motor paralysis is not an essential part of tabes, however, except as a late secondary phenomenon. Occurring early, it indicates the existence of a complication. Erratic extensions of the disease into other areas of the cord give rise to anomalous symptoms, which are considered elsewhere under the head of COMPLICATIONS. The terms acute, severe, and mild appear in the literature of the subject, but are unimportant in significance.

Symptoms. — The symptomatic study of tabes dorsalis may be divided into at least two stages: the incipient, or pre-ataxic, and the ataxic. The line of demarkation is so indistinct and ill defined clinically, however, as scarcely to justify separate consideration, and I shall therefore describe the clinical history as a whole, reserving for a separate analysis of individual symptoms the question of the relation of such symptoms to these two stages.

The disease, as ordinarily observed, begins very insidiously, and its early progress is usually slow. The first subjective evidence realized by the patient may be a sensation of numbness or other paræsthesiæ (tingling, burning, "pins and needles," etc.) occurring in the extremities, or, more frequently, attacks, occurring paroxysmally and without warning, of sharp stabbing pains, usually in the legs, but without constancy as regards distribution. Slight diminution or, rarely, sudden increase in sexual desire or power may be noted about the same time.

Four hundred cases of tabes collected from the private practice of Erb. One hundred of these cases were still in the initial stages. As a primary symptom lancinating pains are most frequently mentioned,—200 times in the legs, 5 times in the back, and once in the arms. Tabes begins, in the majority of instances (67 per cent.), with lancinating pains; nevertheless, these are often not present alone as a first symptom, but are accompanied by one or several others. On the other hand, these lancinating pains may exist for a number of years without the disease manifesting itself in any other way. The frequency of the single symptoms of tabes are given as follows:—

	Per-centage.
Failure of patellar reflexes.....	92.00
Romberg's symptom.....	88.75
Lancinating pains.....	88.25
Vesical disturbances.....	80.50
Ataxia of the legs.....	74.75
Changes in pupillary reaction.....	70.25
Paræsthesia of the legs.....	64.50
Weakness of the legs and quick fatigue.....	62.25
Absence of sexual desire.....	58.25
Changes in size of pupils.....	48.25
Retarded transmission of pain.....	36.50
Hyperalgesia of the legs.....	33.75
Girdle sensation.....	31.00
Transitory diplopia.....	26.50
Hyperæsthesia of the legs.....	23.25
Ulnar paræsthesia.....	16.50
Paralysis of ocular muscles.....	16.00
Atrophy of optic nerve.....	6.75
Persistence of pains in the legs.....	6.00
Crises	5.25
Arthropathies	1.75

Leimbach (Deut. Zeit. f. Nervenh., B. 7, Nos. 5, 6, '95).

Initial symptoms in 111 cases of tabes: Pain, 57 times; ataxia, 24 times; numbness, extremities, 6 times; eye-symptoms, 20 times; nausea and vomiting (gastric crises), 4 times; paralysis of bladder, 5 times; loss of sexual power, 1 time; paralytic attacks, 2 times; mental symptoms, 1 time; neurasthenia, 1 time.

Among the subjective sensations pain was prominent; girdle-pain was present in 27; gastric crises in 9; laryngeal in 2; rectal (and penile) in 1; optic atrophy

was found in 11; eye-muscle paralyses in 33; Argyll-Robertson pupils in 70; in 8 slight reaction to light was present, and in 21 the pupillary reflexes were normal. Ataxia was present in 91, absent in 8. The knee-jerks were normal in 4 cases.

Objective sensory disturbances were present in 78 of 90 cases; typical arthropathies occurred in 5, and perforating ulcer in 5. Mental symptoms were present in 7; in 1, epilepsy had lasted from the fourteenth year up to the time of onset of tabes, at 44. H. M. Thomas (Phila. Med. Jour., from Bull. Johns Hopkins Hosp., Apr., '99).

Fatigue from exercise, as in walking, dancing, or the ordinary occupation, is greater in degree and occurs more quickly than before.

Case in which there was absence of a sense of fatigue in a tabetic patient. This patient was able to hold both arms in an horizontal position for twenty-five minutes without experiencing the slightest feeling of fatigue. Frenkel (Centralb. f. Nervenhe., Psych., u. gerich. Psychop., July 1, '93).

Transient attacks of double vision may be noted with or without ptosis. The normal action of the bladder and sometimes of the rectum may be disturbed. Severe attacks of rectal neuralgia sometimes occur quite early in the disease. Examination at this time will develop the fact that the knee-jerks are either decidedly diminished in activity or even abolished (Westphal's symptom). Tests of sensation may reveal an impaired tactile perception in the distribution of the ulnar nerve (Biernacki), the peroneal (Sarbo) or the popliteal space (Bechterew), or over the plantar surfaces of the feet. The eyes, on examination, will present what is known as the Argyll-Robertson pupil, which consists in a loss of the reflex to light, although accommodation to distance is preserved. The pupils are often quite early found abnormally contracted, sometimes to a de-

gree which has given origin to the term "pin-point" pupil. The pupils may be unequal.

The disease may remain practically stationary at this stage for some time, even for years (Gray), but sooner or later symptoms of ataxia supervene. Ordinarily the ataxia is first noticed by the patient in walking at night or along a narrow pathway or in circumventing obstructions. More effort is required. Hitherto-automatic action in walking, in standing, in dancing, and in other efforts demands more and more conscious attention in order to effect proper co-ordination. Quite early in the development of the ataxic stage the patient will present the Romberg symptom, by which is meant an inability to stand without swaying or falling if the feet are placed close together. Minor degrees of this variety of ataxia can sometimes be demonstrated only with the patient's eyes closed or by having the patient attempt to stand on one foot. In walking the ataxia is manifest in the increasing difficulty with which the patient follows, heel and toe, a chalk line or a carpet-seam or crack along the floor. Here, again, deprivation of the co-ordinating assistance of vision greatly intensifies the difficulty.

[It astonishes me that, in the majority of text-books, a pronounced, and also well-known, initial symptom of tabes is not mentioned,—i.e., the inability to walk backward. OBERSTEINER, Assoc. Ed., Annual, '93.]

The gait becomes characteristic; the feet are kept wide apart and are lifted unnecessarily high, are brought down to the floor with an appearance of unusual and unnecessary force, the heel striking first. Charcot is quoted as stating that he often made the diagnosis of locomotor ataxia from hearing the patient's foot-falls as he approached the examination-

room and before having seen him at all. The patient will often state, in explanation of his defective gait, that he is losing power in the legs. Attempts at forced flexion or extension, the patient resisting, will show, however, that muscular power is intact. The ataxia may extend—in the cervical cases it begins—into the upper extremities. The pianist loses his delicate technique, the machinist his dexterity. Fastening a button, especially when not in the field of vision, becomes a serious problem. If asked to touch the top of his nose with the tip of his finger or to bring his outstretched arms together so as to touch the tips of the right and left forefingers, the eyes being closed, the patient will almost invariably fail. As the disease progresses all these symptoms become intensified and others are added, chiefly sensory. The patient complains of a feeling of pressure or constriction or band of numbness around the waist or chest or throat. Various disturbances of the viscera may develop. Attacks of apparently causeless vomiting, of gastric pain, of dyspnoea, of palpitation, of vesical or rectal tenesmus occur which are known as crises. Certain trophic alterations in the skin, hair, and nails may be present or the teeth may fall out gradually and painlessly. The joints, especially the knees and elbows, sometimes enlarge suddenly, as a rule, without pain, constituting the so-called tabetic arthropathies of Charcot. The bones become easily friable. Abnormalities in the visual apparatus again become conspicuous. The transient strabismus or ptosis of the earlier stage may recur and become permanent. The optic nerve presents the symptoms of atrophy, and total blindness may result. The optic nerve may be—and, indeed, often is—affected quite early in the disease.

Although choked disk may possibly occur as a part of locomotor ataxia, it is exceedingly rare, and when present is nearly always due to syphilitic lesions. Bernhardt (*Berliner klin. Woch.*, July 15, '95).

Case of tabes in which colored vision in both eyes came on suddenly, and has lasted ever since. Everything appears a bright emerald-green color, as if a green veil were before his eyes; everything seems to be on the other side of this veil, which is stationary, and objects move behind it. Sometimes the veil appears continuous in structure, like colored glass, at other times as if made up of minute particles shimmering independently of one another. H. Work Dodd (*Treatment*, Apr. 27, '99).

Lacrymation an earlier symptom of ataxia. The explanation afforded of the condition is that, owing to imperfect action of the orbicularis, the lower lid, and with it the lower punctum, is not kept in proper approximation to the globe, and the tears are thus apt to overflow upon the cheek. Or it may be the expression of a reflex excitability of the facial secretory apparatus, analogous to the hyperhidrosis which is occasionally seen. Mendel (*Med. Record*, Sept. 9, '99).

All forms of common sensation become impaired in varying degrees and different localities. The pains lessen or disappear and an analgesia develops, which may be absolute, but is more often partial and frequently ataxic. The patient, for example, if pricked on the left leg, may refer the painful sensation to the right (allochiria) or to both legs. This phenomenon is sometimes true, also, of tactile and temperature-perception. Pain-conduction may be retarded or delayed. Several seconds may intervene between the actual pin-prick and the patient's conscious appreciation of it.

Careful examination of sixty tabetic patients, with special regard to the disturbances of sensibility. In all of the cases except five, which were tabo-paralytic throughout, hyperæsthesia of the trunk was a constant and early condi-

tion. At the boundaries of the hyperæsthesia and between the lymphatic zones there is generally a pronounced hyperalgesia, particularly as regards cold. Sensory-irritation phenomena are frequent, but not constant. Marked analgesia of the ulnar nerve appears, as a rule, to accompany other disturbances in the ulnar region. Max Laehr (*Archiv f. Psych. u. Nervenhe.*, B. 27, '95).

[It should be here mentioned that the ulnar symptom is also frequently met with in *dementia paralytica*, and is therefore not characteristic of *tabes*. H. OBERSTEINER, *Assoc. Ed.*, Annual, '96.]

Locality of anæsthesia studied in fifty cases of *tabes*, ten of which had amaurosis. Four principal types found: 1. Thoracic, present in 40 cases either as an horizontal zone in the nipple-region of either side, which if it reaches to the axillary line, may extend to the inner aspect of the arms; the nipple bands are united anteriorly. 2. In the upper limbs anæsthesia may be limited to the internal surfaces of the arms, or may extend along the inner aspect of the forearms to the little finger. 3. In most cases of *tabes* the perineal, anal, and genital regions, especially the latter, are anæsthetic, and particularly at the lower part of the scrotum; this is often found in the early stage of the disease. When present it is generally found in other parts as well, such as the thorax or feet. 4. In the lower limbs the position of the anæsthesia is very variable, being common in the plantar and dorsal regions of the foot, the dorsum of the toes, the outer surface of the legs, and on the anterior or posterior surface of the thighs. Other parts of the body where anæsthesia may be found are the epigastrium, the left hypochondrium, and the larynx. Cases of *tabes* with amaurosis often have normal or nearly normal tactile sensations. Subjective symptoms are related to the situation of the anæsthesia; to the first group there is often a girdle sensation, to the second numbness of the arms, to the third troubles of micturition and impotence, and to the fourth, lightning pains and "pins and needles" in the legs and feet. Marinesco (*Sem. Méd.*, Oct. 13, '97).

Case of locomotor ataxia in a man who

presented all the ordinary symptoms of locomotor ataxia; but in addition there was complete analgesia over the whole body except on and around the mouth. The analgesia began in the legs and spread upward. C. E. Beevor (*Lancet*, Jan. 22, '98).

Partial epigastric analgesia noted. Epigastric sensation considerably diminished in 22 out of 50 cases, and completely absent in 9. The epigastric region (the "solar plexus," so called) could be violently compressed or struck without the least feeling of discomfort. This does not appear to be accompanied by any special sensory alteration nor loss of the skin or abdominal reflexes, nor even with gastric crises. The only functional alteration which appeared with any frequency was loss of sensation of hunger. Pitres (*Jour. de Méd.*, Jan. 25, '99).

The writer has had 7.4 per cent. of cases of *tabes* in 1200 patients with various nervous affections in his private practice and 2.6 per cent. in 4000 in hospital and dispensary patients. The proportion of men to women was 83 to 6 in the first class and 87 to 17 in the second. The age ranged from 23 to 73. The longest interval after syphilitic infection before the *tabes* developed was twenty-seven years and in 10 cases it was only one to five years. In 7 instances both man and wife exhibited *tabes*. The primary symptom in 67.5 per cent. of 195 cases was lancinating pains, while diplopia was noticed as the first symptom in 3.6 per cent., and gastric symptoms, vertigo, or paræsthesia were the first in 3.1 per cent. each. Weakness of the feet was the first symptom in 2.7 per cent., and bladder symptoms, gastric crises, or impaired vision were each the first in 2.2 per cent. In 1.6 per cent. the girdle sensation first attracted attention; in 1.1 per cent. the heart-crises or painful lassitude. In 0.5 per cent. the first symptom noted was dyspnœa, deafness, ptosis, or the Argyll sign.

In the total of 195 cases lancinating pains occurred at some stage of the affection in 93 per cent., the Romberg in the same proportion, and the ankle-

clonus was abolished in 91 per cent. Westphal's sign occurred in 89.4 and the Argyll in 88.8 per cent. Analgesia of the peroneus region in 85.5 per cent.; bladder symptoms in 79 per cent.; paræsthesia in 72; analgesia in ulnar region in 66, and atrophy or blanching of the optic nerve in 61 per cent. Anisocoria in 46.6 per cent., bilateral myosis in 21, and mydriasis in 14 per cent. Crises in 13.7 per cent., paralysis of ocular muscles in 10.5 per cent., and trophic disturbances in 4.5 per cent. A. von Sarbo (*Deut. Zeit. f. Nervenhe.*, xxiii, Nos. 1 and 2; *Jour. Amer. Med. Assoc.*, April 25, 1903).

The muscular sense is invariably impaired in some degree and in nearly all of its subdivisions — position, weight, pressure, etc. If the eyes are closed the patient may not be able to tell whether a given muscle or set of muscles is being flexed or extended, pronated or supinated, by the examiner. If two wooden globes, exactly alike in appearance and size, but differing materially in weight, are placed in the hands of the patient, he cannot distinguish the heavier from the lighter. Pressing unequally with the hands upon the patient's thighs or other symmetrical parts of the body, he is unable to distinguish the inequality. The temperature sense may be also affected so that variations in the degree of contact heat or cold are not appreciated. Finally, a condition of motor helplessness or paresis may be superadded to the sensory disturbances.

Several variations in the picture described, particularly as regards the order of precedence in symptoms, may occur. The disease may begin with an initial ataxia; it may begin with an optic neuritis or atrophy. In rare instances the earlier symptoms are referable to lesions in the cervical cord, the upper and not the lower extremities being affected first symptomatically. Such cases are known as cervical and sometimes as superior or

descending tabes, though the two latter terms have also been applied to general paresis with secondary posterior spinal sclerosis. Painful sensory phenomena are much more marked and persistent and wide-spread in some cases than in others. The shooting, stabbing, grinding pains in the legs, the rectal pains, the trigeminal pains, the painful crises, may be all extreme and give rise when present to what has been termed the neuralgic type. If the disease develops within a year or two after primary syphilis, the symptom-picture takes on more distinctly the bizarre characteristics of exudative nervous syphilis.

The following are the cardinal symptoms in the order of their importance: (1) failure of knee-jerks; (2) Romberg symptom; (3) Argyll-Robertson pupil; (4) lightning pains; (5) loss of functions of the bladder or sexual organs. With the presence of any three of these symptoms the diagnosis may be made with certainty. And in the presence of any two with probability, when evidence pointing to multiple neuritis, parietic dementia, or cerebro-spinal syphilis is absent. Among the important secondary symptoms or signs are: (a) paræsthesia, anæsthesia, or analgesia of the legs, (b) locomotor ataxia, (c) transient ocular palsies, (d) paræsthesia in the ulnar distribution, and (e) optic atrophy. With the presence of two of the cardinal signs and one of the secondary signs, the diagnosis may be made with certainty. With the presence of two of the secondary and only one of the primary, it may also be made, and even in the absence of all of the cardinal symptoms. Theodore Diller (*Amer. Med.*, June 1, 1901).

Review of the publications of 1903 on tabes. There has been a tendency to class under the name of tabes lesions differing in site from those of ordinary tabes; thus the syphilitic spinal paralysis of Erb may be called motor tabes, and the chronic ophthalmoplegia following syphilis tabes of the eye muscles. The pathological anatomy of the subject has been studied with the

utmost care in France. Nageotte recognizes syphilis as the cause of tabes, but holds that a real syphilitic meningitis is present, with a spread of inflammation to the nerve roots. Both Nageotte and Marie appear to overlook the systemic nature of the disease, the primary affection of the eye muscles, and the uniformity of the process as a whole. Thomas and Hauser have published a large work on the anatomy of tabes. They differ from Nageotte, and believe that a primary segmentary death of the posterior roots and spinal ganglia occurs, resembling a toxic nerve atrophy. The view that syphilis is essential to the production of tabes gains ground, especially in France. "Traumatic" tabes is still spoken of, but scarcely needs serious consideration. Nonne, although he describes cases which speak strongly for syphilis as the cause of tabes, recognizes tabes without syphilis. Pitres has inquired into the family history of 209 married tabetic patients. Of these, 42 had no children; 32 had among them 67 children who were stillborn or died soon after birth; and 135 had 286 living, and for the most part healthy, children, and 130 who were stillborn or died almost immediately. Among the deaths a larger proportion belonged to the children of the fathers who acknowledged to syphilis. Brooksbank James describes a family in which the father was syphilitic, and two, if not three, of the children suffered from tabes. Brissaud points out that the classical type of locomotor ataxy appears to be less frequent of late, and to be giving way to an incomplete, slowly advancing, stationary, or even retrogressive, form of the disease. How far treatment by mercury has led to this result is still a matter of dispute. Collins finds loss of the Achilles tendon reflex in 88 per cent. of cases, loss of knee-jerk in 84 per cent., and of the triceps in 13.3 per cent. According to Sarbo, the age of onset is earlier among the working than among higher classes. Lightning pains were the earliest symptom in 67 per cent. of his cases; at a later stage the symptoms in order of frequency were,

first, lightning pains and Romberg's sign; then loss of the Achilles tendon reflex, loss of knee-jerk, reflex pupil changes, bladder and optic nerve changes. Kollarits, after careful study of the different reflexes, finds that the Achilles tendon reflex is most frequently lost. Carrez has tested the sensitiveness to deep pressure in different regions of the body and finds that although analgesia as a rule progresses with the disease, isolated sensory changes may be present at any stage; for example, loss of sensation in the tongue may occur as an isolated sensory symptom early in the disease. According to Förster, the changes whether of increase or decrease in the innervation of muscle groups are due to the loss of centripetal impulses, and tabetic crises are the expression of a permanent state of irritation, culminating in an explosive paroxysm in the sensory and motor secretory fields. Pierret differentiates between a purely motor or a purely sensory tabes, with brain symptoms on the one hand, and a true meningo-encephalitis on the other. Cassirer looks upon tabes and general paralysis as distinct diseases, and believes that paralysis is too often diagnosed in cases of tabes with mental disturbance. The more correct opinion is, however, probably that paralysis is more often overlooked, but the difficulty in establishing a diagnosis is such that the question cannot be absolutely settled. O. Meyer, among 30 cases of tabes with mental symptoms, has had no case of paralysis. Widai and Genossen have given a new method of diagnosis. The fluid obtained by lumbar puncture is centrifugalized, and the deposit examined microscopically. In healthy subjects no small lymph corpuscles can be seen, but in cases of syphilis and tabes six to ten at least of these bodies are visible in the field. Babinski and Nageotte have found lymphocytosis present in twenty-five out of twenty-six tabetic patients, and other writers have obtained similar results. P. J. Möbius (*Jahr. der in. u. ausland. Gesém. Med.*, Jahrgang, 1904, ht. i: *Brit. Med. Jour.*, Sept. 24, 1904).

SYMPTOMATIC ANALYSIS. — *The Reflexes.*—One of the earliest—possibly the earliest demonstrable—symptom of locomotor ataxia is a diminution in activity of the patellar-tendon reflex. This diminution may be first unequal on the two sides, but, as the disease progresses, both knee-jerks are affected and eventually lost (Westphal's symptom). So constant is this symptom as to have been considered pathognomonic by some writers (Buzzard). Absence of the knee-jerks may exist in persons who are otherwise healthy, although such instances are not at all common. The integrity or abnormality of the knee-reflex may be elicited by various methods, the simplest of which is to have the patient "cross" the leg carelessly, when, with the side of the extended hand or a percussion-hammer, a sharp tap over the tense patellar tendon will ordinarily demonstrate, in the resultant jerk of the leg, the normal or exaggerated presence of the tendon-reflex, or, in the absence of response, the loss of such reflex action. Such a test, however, is crude, and should not be considered final unless practiced in conjunction with some one of the methods of sensory or mental reinforcement, the simplest of which is that known as Jendrassik's. This consists in having the patient grasp the hands tightly and look up at the ceiling, or at least away from the field of examination, as the tendon is struck. While abolition of the knee-jerk is exceedingly constant as a part of the symptom-picture, occasional examples of the disease have been noted in which the reflex was preserved and remained intact. Westphal himself, as well as Pick, Krauss, Lehman, and, more recently, Achard and Levi (*La Méd. Mod.*, 9, p. 167, '98) have reported such instances, the explanation being found in the non-involvement, by the disease-

process, of the zone of entry (*wurzell eintritt*) of the corresponding posterior roots. The occurrence of hemiplegia in a tabetic patient may result in the return of the knee-jerk, which may even be exaggerated in such cases.

The studies of Sherrington upon the phenomena connected with the patellar-tendon reflex are of especial interest in this connection.

[Mills, following the observations of Babinski (*Le Prog. Méd.*, Oct. 29, '98) as to the significance of the tendo-Achillis jerk in tabes, examined 100 cases of nervous disease, 28 of which were tabes, with regard to this point. Of the non-tabetic cases, it is sufficient to state that he found this reflex present and equal in all of the 72 patients. Of the 28 tabetics only 3 exhibited the tendo-Achillis jerk and in all three the knee-jerk was also present. In one the phenomenon was well marked, in another slight and in the third present only on one side. Mills thinks that an investigation of the tendo-Achillis jerk may prove of diagnostic importance in removing the element of doubt present in the cases of tabes occasionally encountered in which the patellar-tendon reflex is preserved, such cases usually showing alteration of the Achilles-tendon jerk. W. B. PRITCHARD.]

In early tabes the cutaneous and superficial reflexes are preserved and may be exaggerated: a fact of some diagnostic significance, in the opinion of Bechterew (*Revue de Psych.*, No. 8, '97). In the late disease these also are lost.

Twenty-six cases of tabes investigated in which the patellar and ankle reflexes were absent in all the cases. In 11 patients in the preataxic stage, the abdominal reflexes were strongly increased on both sides in 10 and well marked in 1; of 10 cases in the ataxic stage the abdominal reflexes were much increased in 3, well marked in 5, very slow in 1, and not present in 1; of 5 cases in the paralytic stage, the abdominal reflexes were completely absent in 4 and in 1 case were

increased. Ostankow (Neurol. Centralb., p. 140, '98).

The earliest, most constant, and obtrusive symptoms of locomotor ataxia in its early stage are: absent knee-jerks, shooting or lightning-like pains, and loss of iritic reflex. J. T. Eskridge (Charlotte Med. Jour., Dec., '98).

Conclusions to be drawn from observations upon the biceps-tendon jerks in twenty-nine cases of tabes: The ataxia in the arms is, as a rule, more marked when the biceps-tendon jerk is absent. It is also usually marked when the same is found in the legs. In these the biceps-tendon jerk is absent. In the presence of the biceps-tendon jerk with slight ataxia in the arms, ataxia in the legs is invariably well marked. Sensation is usually normal in those cases with normal biceps-tendon jerk. The sensory losses are usually found when the biceps-tendon jerk is absent. Arthropathies are only found in the advanced cases. Astereognosis is only present in the markedly ataxic. The loss of the sense of position is almost constant in the advanced cases of tabes. The shooting pains in the arms do not bear any relation to the degree of ataxia. The marked ataxics seldom show the loss of weight-sense. The intensity of the symptoms is not dependent on the duration of the case, but rather upon the extent of the sclerotic process. In those cases in which the biceps-tendon jerks are absent the sclerosis probably extends to the cervical region; but this reflex may be absent in normal individuals. Moses Behrend (Phila. Med. Jour., June 1, 1901).

Pupillary Symptoms. — Fixed pupillary contraction (spinal myosis); a loss, abruptly, or gradually progressive, of the reflex action to light; accommodation to distance and in convergence being preserved (reflex iridoplegia, Argyll-Robertson pupil) with loss of the sympathetic skin-reflex, are the more constant and characteristic pupillary abnormalities in tabes. Both eyes are usually affected and to about the same degree. The

iridoplegia may be unilateral, however; and the two pupils may be unequally contracted or one only may be abnormally small. Permanent mydriasis or dilatation has been rarely observed.

The Argyll-Robertson pupil is, perhaps, the most constant and characteristic symptom in posterior spinal sclerosis. It is also an early symptom invariably, and in combination with abolished knee-jerks affords sufficient data for diagnosis even in the absence of all other symptoms. In late tabes the action of the pupils in accommodation is also lost.

Case of man suffering from tabes dorsalis, who, when examined in 1896, had the characteristic signs of the disease, with the exception that the pupils reacted both to light and in accommodation. Four months later the symptoms were still more pronounced, and the pupils failed to react either to light or in accommodation. This condition continued for nearly a year, when it was found that the pupils reacted well to light and continued so to react for the remainder of the period during which the patient was under observation. The case illustrates improvement in the pupillary symptoms, while the general symptoms grew worse. Treupel (Münchener med. Woch., Aug. 30, '98).

Two cases of intermittent Argyll-Robertson pupil in tabes dorsalis. Both patients were women 38 years of age. In both cases there were evidences of syphilis, and the symptoms of tabes were plain. The pupil reflexes varied under continued observation and notwithstanding steady progress of the disease. Eichhorst (Deut. med. Woch., No. 23, '98).

The lesion in Argyll-Robertson pupil is probably in the fibres which pass from the proximal end of the optic nerve to the oculomotor nerve, according to de Schweinitz, who quotes Turner, however, as believing that a single lesion in the forepart of the oculomotor nuclei in the Sylvian gray as the cause of both myosis and reflex iridoplegia.

Optic Atrophy. — This symptom may occur at any stage, though usually it is present in early tabes. It has been found in from 10 to 35 per cent. of cases according to the observer. Bergur found it present in 44 of 109 cases. Disturbances of color-sense and contraction of the visual field are associated phenomena. The progress of the atrophy is usually slow, and remissions may occur. Blindness ensues in from three to five years. The ataxia and also the painful sensory symptoms diminish upon the onset of blindness, as a rule (amaurotic tabes). The left eye is said to be attacked oftener than the right. Both eyes are usually involved, however.

The onset of optic neuritis in the early stage of tabes is followed by improvement in other symptoms, and retards or arrests the further course of the disease. Martin (*Neurol. Centralb.*, Oct. 1, '90).

Five cases of tabes in which atrophy of the optic nerve preceded the usual symptoms of tabes during a long period (up to twenty-five years). Howell Pershing (*Med. News*, Mar. 26, '92).

The specific motor symptoms in tabes begin to disappear as soon as atrophy of the optic nerve sets in. Benedikt (*La Méd. Mod.*, Mar. 20, '95).

In about 75 per cent. of the cases of tabes, in which optic atrophy is an early symptom, some of the other tabetic symptoms may be late in appearing or may not develop at all. This is especially the case in respect to the lightning pains and the inco-ordination of movement. The loss of knee-jerk in such cases is very constant.

The most distressing symptoms may develop simultaneously with or immediately succeed the blindness.

The association with the optic atrophy of oculomotor palsies is without prognostic significance. Pearce Bailey (*Med. Rec.*, Nov. 14, '96).

Ophthalmoscopically the optic atrophy of posterior spinal sclerosis presents the appearance of primary degenerative at-

rophy in contrast to the appearance in that form which follows neuritis.

Ocular-Muscle Palsies. — One of the first symptoms in locomotor ataxia may be an attack of double vision with or without ptosis. Occurring in the early stages of the disease, such attacks are usually of abrupt onset and transitory duration, disappearing completely in a few days or weeks. Well-marked strabismus, most commonly of the variety due to sixth-nerve involvement, may be present, and, if an early symptom, is equally abrupt in onset and transient in duration. Möbius believes that sudden painless ocular palsies in an adult are almost pathognomonic of tabes. They are certainly exceedingly suggestive. Ptosis, more or less decided, is frequently noted in late stages of posterior spinal sclerosis. Such ptosis is usually of slow progressive development and remains permanent. This is true, also, of strabismus. Ophthalmoplegia, both external and internal, has been sometimes observed, though with decided infrequency.

Transient ptosis, or diplegia, Argyll-Robertson pupil, incipient optic-nerve atrophy, associated in an individual past middle life, of inherited neurotic tendency, are strong presumptive evidence of the first stage of locomotor ataxia. Hansell (*Jour. Nerv. and Mental Dis.*, Apr., '93).

Slight paresis of the ocular muscles, particularly in the early stages of tabes, even though of temporary duration, is of very frequent occurrence, though often overlooked. G. Rummo (*Lezioni di Clin. Med.*, 894).

The eye symptoms, especially the pupil symptoms, are among the most important early means of diagnosis, and are met with in almost every case. Hardly any are exempt throughout; the Argyll-Robertson reaction is found in about 75 per cent. of all cases, and inactivity to light and convergence in 15 per cent. Inequality of the pupils or extreme contraction may call atten-

tion to the condition before the discovery of other diagnostic signs. Inequality is less common in tabes than in the other forms of the disease. Disturbances of the muscles are also an early sign, but not so common as disturbance of the pupil reactions. Diplopia as a result of paresis is often a transitory symptom, and attracts little attention. Optic atrophy is very common. It is probable that most cases of primary atrophy eventually develop spinal disease. Mott (Ophthalmoscope, Aug., 1903).

Ataxia.—The disease may manifest itself first in an ataxia of gait or station (acute locomotor ataxia). Usually, however, as has been already stated, various sensory and other symptoms prominently precede the ataxia, disturbances of co-ordination being essentially dependent upon impaired centripetal or sensory impressions. Loss or defect of muscular sensibility and particularly of position-sense is the dominant factor responsible for the ataxic gait and the inco-ordination of the upper extremities. The phenomenon known as Romberg's symptom is probably due to the associated involvement of both tactile and muscular sensibility. Leyden's experimental induction of this symptom by freezing (anæsthetizing) the soles of the feet with ether-spray demonstrates at least some participation of the tactile sense in the production of this symptom. Helplessness from ataxia should be, it is scarcely necessary to state, carefully distinguished from helplessness due to true motor paralysis or paresis.

Romberg's symptom is caused solely by a feeling of dizziness when the eyes are closed. Grasset (Archives de Neurol., vol. xxv, '93).

Case of locomotor ataxia in which, notwithstanding the fact that the patient was perfectly blind, he could stand with his feet close together with but little swaying. The moment he closed his eyes, however, he swayed violently, and would

fall over if not supported. F. F. Ward (Med. Rec., Oct. 8, '98).

Tabetic Crises.—These consist of attacks, occurring suddenly, without assignable cause and ending quite abruptly, as a rule, which may simulate symptomatically ordinary attacks of gastric, intestinal, nephritic, vesical, or hepatic colic. Gastric crises are most common. The patient is suddenly seized with excruciating gastric or abdominal pain, which is usually accompanied with violent retching and vomiting. The attack may be prolonged for two or three days or it may end after a single paroxysm lasting a few minutes, recurring at varying intervals from a week to several months. Except from malnutrition, such attacks are not dangerous.

Case of man in the paralytic and atrophic stage of tabes, whose gastro-intestinal crises were accompanied or ushered in by profuse sialorrhœa, beginning suddenly, often at night, and nearly choking the patient. Gastric crises would follow, then intestinal crises, sometimes accompanied by genito-urinary symptoms, the attacks lasting from three to twelve days. Girode (La France Méd., Feb. 19, '89).

Case of tabetic patient in whom, simultaneously with the gastric crises, pronounced acuteness of the sense of smell is present. Negro (Rev. Clin. de los Hosp., Mar. 8, '94).

Three cases of tabes in which gastric crises were the first symptom, and, later on, remained the dominant one. There was a constant lack of hydrochloric acid both during the crises and in the intervals. L. Wolff (Lakärc. Förhänd., '95).

[It is striking that gastric crises are very frequently combined with laryngeal symptoms and are seldom absent when arthropathies are present. H. OBERSTEINER, Assoc. Ed., Annual, '96.]

When, however, the heart's action or the functions of respiration are involved, the danger is much greater, fatal results having been recorded in both cardiac and laryngeal crises. Both varieties, fortu-

nately, are rare. The symptoms in laryngeal crises are not unlike those of laryngismus stridulus: dry, violent cough, with spasmodic inspiration and marked dyspnoea and at times loss of consciousness. Burning pains in the neck and shoulder-muscles sometimes attend these laryngeal crises.

Two cases of tabes: one with laryngeal crisis, the other with hyperæsthesia to light and sound. Charcot (La Sem. Méd., June 4, '90).

Case of tabes with laryngeal crisis, in which the post-mortem histological examination revealed, besides the usual characteristic spinal lesion of tabes, a bilateral chronic diffuse neuritis of the vagus and spinal accessory roots, but without involvement of the nuclei of these nerves. Van Gieson (Jour. of Nerv. and Mental Dis., July, '90).

Attention called to peculiar pains in certain glands which may occur in tabes from time to time. Several hours before the onset of the attack the patient complains of a peculiar, uncomfortable sensation in the region in question, and suddenly very severe pain is felt, lasting several hours; the glands quickly swell, and the skin becomes reddened; the swelling and redness slowly disappear after a few days. Wood (La Sem. Méd., No. 7, '93).

Case with pharyngeal crises. Patient was a man who had become exceedingly emaciated, the slightest attempt at taking nourishment causing severe contractions of the pharynx. After a single treatment by suspension, this condition entirely disappeared. Courmont (Revue de Méd., Sept., '94).

Two cases of severe pharyngeal crises, one of the patients dying during such an attack. Moreira (Pharingismo Tabetico, '94).

In 122 cases of tabes laryngeal disturbances referable to tabes were found in 17 cases. In 4 cases laryngeal crises were observed. Bohne (Inaug. Dissert., '95).

Cardiac Crises.—Cardiac crises resemble symptomatically attacks of angina pectoris. There may be actual disease of the heart of trophic origin. A rapid pulse—100 to 120—was frequently

noted in Charcot's cases without associated cardiac crises.

In 138 cases of locomotor ataxia 12—or 8.76 per cent.—were complicated with valvular disease. In 9 of the cases—or 6.5 per cent.—the lesion was aortic disease. The valvular affection generally first showed itself after the tabetic symptoms were well advanced. Five cases were undoubtedly syphilitic, and 6 probably so, but in 1 case there was no evidence of the disease. In 2 cases aortic aneurism was associated with the valvulitis. Rheumatism was only noted in 2 of the 12 cases. As symptoms are not always present, the aortic disease may be overlooked. The association of the two diseases is probably the result of syphilis, which is an important cause, both of tabes and of cardiac disease. Ruge and Hutter (Berliner klin. Woch., Aug. 30, '97).

Disease of some part of the circulatory system is present in nearly all cases of advanced tabes. Valvular heart disease occurs in a large percentage of the cases. The intimate relationship existing between syphilis and tabes and the pronounced circulatory changes induced by the former make it reasonable to regard syphilis as the cause of the large percentage of cases of valvular heart disease which we find associated with tabes. B. F. Stahl (American Medicine, Nov. 4, 1903).

The crises of tabes possess a localizing pathological value quite analogous to that of the aura or signal symptom in epilepsy, pointing to an invasion and irritative degeneration of the vagus-nuclei or fibres, or to fibres elsewhere that are in physiological relation to the functions involved in the symptoms. Crises are among the earlier clinical phenomena usually, but they may persist for many years. They often disappear with the lancinating pains, with which they are intimately associated, as the disease advances.

A constant secretion of tears is sometimes met with in tabes, while in other cases there are actual tear-crises, similar

to gastric crises. Panas (*La Presse Méd.*, May 4, '94).

Case of a waiter, 41 years old, who suffers from locomotor ataxia and beginning paralytic dementia. He has frequent and sudden attacks of violent burning pain in both eyes and the peribulbar tissues, accompanied by spastic myosis, epiphora, and chemotic swelling of the conjunctivæ. There also is much hyperæsthesia in the eyelids, which makes further examination of the eyes impossible. These attacks last from two to three hours; an hour after the attack the eyes are practically normal. These attacks considered to be true ocular crises—attacks of neuralgia of the ciliary nerves, and irritation of the fifth nerve. Pel (*Berliner klin. Woch.*, No. 2, Jan. 10, '98).

Sensory Symptoms.—The defects or abolition in the several forms of common sensations have been sufficiently described in the clinical history of which they form an exceedingly constant and essential part. Among the less frequently noted sensory phenomena are analgesia of the testicle and anæsthesia in the distribution of the fifth nerve, especially over the mucous membranes of the mouth and eyelids.

Frequent changes in the pharynx and larynx of 36 tabetic patients. There were sensory disorders of the pharynx in 14, of the larynx in 10, paresis of the adductors in 10, immobility of the cords in 4, diminished power of adduction in 8, and ataxic movements of the tongue in 9. The pharyngo-laryngeal disorders were more intense in the advanced stages of tabes. Marini (*Archiv f. Psych. u. Nervenk.*, B. 21, H. 1, '90).

Case presenting the typical signs of tabes of many years' duration, in which lancinating pains occurred in the left side of the face, and in which the pharynx was insensible to the touch, and the uvula anæsthetic and paretic. Speech and deglutition, however, were not affected. Schnell (*Marseille-méd.*, Oct. 15, '91).

Case of male tabetic patient, with ulcerations both in the region of the right

upper and the left lower jaw. These ulcerations are to be referred to a tabetic neuritis of the trigeminus, since complete anæsthesia of the face and mucous membrane of the mouth was present. Hudelo (*Bull. de la Soc. Française de Derm. et de Syphil.*, May 18, '93).

Pitres found analgesia of the testicle in 75 per cent. of his cases. It varies in degree from time to time and may disappear entirely to return, however, after varying intervals. Its disappearance has been noted as occurring simultaneously with a return of sexual power. While pain is a very common symptom in many forms of nervous disease, the sharp stabbing vagabond pains which occur in locomotor ataxia are so distinctive in character as to be unique. No two patients will, perhaps, describe them in the same way, and yet their identical character is at once evident from the description of a dozen or more patients. They are often worse at night and under barometric conditions of excessive humidity presaging a storm. Tabetics are often, indeed, quite reliable weather-prophets.

Of 34 tabetics, 8 had normal testicles, 10 were hyperalgesic, and 16 analgesic; of the latter 4 had atrophy of the testicle. Pitres's sign considered of great value. It consists in the loss or diminution of the characteristic pain produced in the normal testicle by compression. Bitot and Sabrazès (*Jour. de Méd. de Bordeaux*, Feb. 2, '90).

Among 35 tabetic patients, both testicles were normal in 11, in 4 there was bilateral analgesia; in 4 bilateral hyperæsthesia; in 2 there was atrophy of both testicles; in 2 atrophy of only the right testicle; in 7 diminished sensibility of the penis; and in 11 impotence. Analgesia of the testicles and failure of the cremaster reflex are entirely independent of each other. In 15 patients incontinence was found, in 3 retention, and in 1 ischuria paradoxa (constant dropping of urine from a full bladder). B. A. Tatartscheff (*Die Urogenital Storungen bei Tabes Dorsalis*, '92).

Trophic Symptoms.—Some degree or variety of trophic disturbance is usually manifest at some time during the progress of the disease. Such trophic disturbances do not appear as complications, but are essentially a part of the disease. Occurring in the early stages, they are due to involvement of the peripheral tropho-sensory fibres; late trophic symptoms may be dependent upon lesions of the ventral horns. Among the trophic symptoms are superficial and perforating ulcerations of the skin and other cutaneous lesions, loss of the hair or teeth, onychia; atrophies of muscles, singly or in groups; nutritional disease of the bones, particularly the femur, giving rise to spontaneous fractures; affections of the joints known as arthropathies, with secondary luxations and displacements; œdema, and bed-sores.

Case of man in whom there were transverse fractures of both the upper thigh-bones without any apparent cause, the second fracture occurring after an interval of four months. The retarded consolidation, with the enormous callous formation, go toward proving a medullary cause for these spontaneous fractures. Fourmeaux (*Jour. des Sci. Méd. de Lille*, June 16, '93).

Tabetic patient in whom a great many cerebral nerves were diseased, even the seldom-affected facial nerve. Asymmetry of breathing was particularly noticeable, the left half of the thorax being much less active than the right. Chvostek (*Neurol. Centralb.*, Nov. 15, '93).

Multiple lipomata witnessed in personal case: These may be regarded as a peculiar trophic manifestation in tabes. The patient suffered from lancinating pains and paræsthesia in the lower extremities. After two years these symptoms disappeared and instead small lipomata appeared simultaneously on both forearms, at first growing larger and then remaining stationary. Similar lipomata then appeared on the hips and thighs. The unmistakable symptoms of tabes only presented themselves later on.

Tscherkassoff (*La Méd. Mod.*, Mar. 25, '95).

Perforating ulcers almost invariably develop on the plantar surfaces of the feet, often beneath the great toe, and may be symmetrical. Such ulcers may occur quite early in the disease. I recall the case of a patient in whom such ulcers led to the discovery that he was suffering from locomotor ataxia, the discovery overwhelming him with surprise.

Herpes is not an uncommon accompaniment of the severe neuralgic or neuritic pains sometimes observed. Baldness or anomalies in pigmentation, especially the former, are common. The teeth may all fall out as a result of involvement of the fifth nerve.

Atrophy of the jaws, with loss of the teeth, frequently occurs in tabetic patients. Rosin (*Deut. Zeit. f. Nervenh.*, vol. i, '92).

Case of tabes with bilateral atrophy in the region of the trigeminus, loss of the teeth, paralysis of the soft palate, laryngeal crises. There was found degeneration of the ascending (spinal) root of the trigeminus, of the ascending glossopharyngeus root (*fasciculus solitarius*), and of the substantia feruginea. Pacetti (*Trans. Eleventh Inter. Med. Congress*, '94).

Spontaneous loss of the teeth most frequently occurs in the later stages of the disease, and is due to the diseased condition of the nervus trigeminus. Lemaire and Bernard (*L'Odontologie*, Feb., '94).

Case of tabes with perforating ulcer of the mouth and loss of the teeth. No other bulbar symptoms were present. Letulle (*Revue Neurol.*, Oct. 15, '94).

Onychia is sometimes very troublesome, and wounds or operations upon the extremities, especially the feet, may prove quite obstinate in healing. Muscular atrophy, if extensive and affecting groups or an entire limb, is a late incident in the disease. Extensive atrophy occurring early indicates a probable complication. Atrophy of single muscles

may occur, though not frequently early, as a result of the neuritis.

From 10 to 12 per cent. of all tabetic patients are affected with muscular atrophy. This tabetic muscular atrophy is principally characterized by the great slowness of its development; fibrillary contractions and degeneration reactions are not present. Déjerine (*Ann. de Méd. Thermale*, '92).

Case of tabes in a female patient in which there was also increasing paralysis and atrophy of the lower extremities. These symptoms were due to atrophy of the peripheral nerves of the lower extremities, as was proved by the post-mortem. Goldscheider (*Zeit. für klin. Med.*, vol. xix, '92).

Case of tabes in which there existed a general muscular atrophy and also marked involuntary movements of the lower extremities and of the face during sleep. Lacaze (*Montpellier Méd.*, No. 1, '93).

Some degrees of muscular atrophy is not uncommon in tabes, occurring in about from 15 to 20 per cent. of the cases. The muscular atrophy that is occasionally encountered with tabes, and which resembles in its distribution and course progressive muscular atrophy of spinal origin, overshadows the tabes, which is rarely typical, in its clinical delineation. Joseph Collins (*Jour. of Nerv. and Mental Disease*, June, 1903).

The arthropathies and osteopathies, which are ordinarily associated phenomena, have been especially studied by Charcot, Déjerine, and others. They occur in from 5 to 10 per cent. of cases. The knees are chiefly affected. The smaller joints usually escape, though Hirtz (*La Méd. Mod.*, 9, p. 48, '98) has recently reported a case with radiographic illustrations, involving the metatarso-phalangeal articulations. In some cases there exists, without swelling or deformity, a remarkable relaxation of the muscles of the knee and other joints, permitting extreme degrees of hyper-

flexion and hyperextension. This condition has been called "hypotonia" by Frenkel, who considers it an early symptom.

Three cases of ataxic arthropathy in one of which the disease of the joint was one of the first symptoms of tabes. Krögius (*Finska Lakäresäll. Händ.*, vol. xxxv, '93).

Case of pronounced gonitis tabetica. As the diseased leg was a great hindrance in walking, it was amputated at the thigh. R. Rasmus (*Inaug. Dissert.*, '94).

Attacks of œdema in the extremities or elsewhere, usually transient and of a type similar to angioneurotic œdema, have been noted. Bed-sores on the sacrum, over the trochanters, or at other points exposed to prolonged pressure are ordinarily late symptoms and belong to the bed-ridden stage. In this connection, an emphatic protest might be introduced against the custom, sometimes practiced for the relief of pain in the legs, of tightly binding a cord or ligature around the limb. It may, and sometimes does, effectually relieve the pains, but at great risk of inducing far more serious trophic disturbances.

Vesical, Rectal, and Sexual Symptoms.—Slight incontinence or slowness in micturition may first attract attention to the possibility of tabes. This may vary from time to time, and is rarely extreme or particularly annoying. In the late stage of the disease there may be partial or total anæsthesia of the bladder, with either absolute incontinence or the opposite condition of retention. The urine may be retained without discomfort for many hours, and, unless withdrawn by catheter, a cystitis may develop. Catheterization should be practiced very carefully in such patients.

Tabetics are almost invariably constipated, although in the advanced disease incontinence of fæces may be present.

The rectal region may be the site of sharp, stabbing pains in neuralgic cases. Sexual desire and power, while invariably impaired or abolished in the advanced disease, is sometimes, in the beginning of tabes, quite distinctly exaggerated, the patient being led into the grossest excesses in sexual intercourse. Such paroxysmal satyriasis may give way to total temporary abolition of sexual function, the paroxysms recurring at varying intervals.

Peculiar localization of the crises in females affected with locomotor ataxia—first mentioned by Charcot. They appear early in the disease and are associated with the usual lancinating pain in the limbs. The spasms of the clitoris occur at frequent intervals and may be accompanied by ejaculations of mucus or by spasms of the *constrictor cunni* without pleasurable sensations. Köster (Münchener med. Wochen., No. 5, 1901).

Special Senses.—In addition to vision, hearing, taste, and smell are each or all of them sometimes impaired. Hearing is affected in about 25 per cent. of all cases. Deafness is sometimes, though rarely, due to atrophy of the auditory nerve, sometimes to a trophosclerotic condition of the middle ear through involvement of the fifth nerve.

In 20 cases of tabes auditory disturbances found in only 5; of these, 10 per cent. had nervous deafness. Tabes not infrequently causes trophic changes in the middle ear (a sclerotic process), which may lead to disturbances of hearing. Treitel (Arch. of Otol., Oct., '90).

Series of 40 cases of tabes, 7 of which had normal hearing; 29 had some affection of the auditory apparatus, of which 4 had middle-ear disease, and 15 had positive internal-ear disease, which was also suspected in the remaining cases. Ménière's symptoms were not found in any case. Marini (Archiv f. Psych. u. Nervenk., B. 21, H. 1, '90).

Tabetic lesions of the auditory nerve are usually only present in the preataxic stage, notably in cases of so-called tabes

descendens. Cozzolino (Revista Clinica e Terap., Feb., '94).

Only four cases of tabes have been met with up to the present in which atrophy of the acoustic nerve was discovered at autopsy. In the great majority of cases there is a sclerotic affection of the middle ear, which may be considered as a trophic disturbance following a diseased condition of the trigeminus nerve. Usually there is a more or less pronounced deafness, which is generally very quickly developed, often in a few months. In more than half of the cases a subjective noise precedes the deafness, the sound being of varied nature (musical, whistling, buzzing, etc.) and also of varying intensity, sometimes excessively loud. Collet (La Presse Méd., Jan. 12, '95).

Taste and smell are believed to be rarely affected, though Klippel (Archiv de Neur., 3, p. 257, '97) does not agree with this statement, believing that these two senses are much more frequently involved than is indicated in the literature. They are, moreover, among the earliest symptoms in tabes, according to this author, who describes the findings in a case of tabes presenting these symptoms, which came to autopsy, consisting of marked degenerative disease of the olfactory, glosso-pharyngeal, and trigeminus nerves and their ganglia.

Watchfulness necessary to avoid overlooking incipient or atypical forms. Five cases cited in which there were practically no objective symptoms. The subjective disturbances were of the slightest: obscure lancinating pains, slight disturbances of sensation, lassitude, diminished sexual vigor, headache, etc. Pupillary sluggishness or inaction was, however, noted in several instances. In doubtful cases the presence or absence of a syphilitic history is of great importance; when preceded by a specific infection, symptoms which otherwise would be negligible assume the gravest significance. Erb (Münchener med. Woch., July 17, 1900).

Diagnosis.—The chief and most important problem in diagnosis is with re-

gard to the prompt recognition of the incipient or preataxic stage. No single symptom is pathognomonic, although the Argyll-Robertson pupil is considered by Möbius and others as invariably indicative of either locomotor ataxia or general paresis. The conjoint association of any two of the four most constant symptoms—abolished knee-jerks, Argyll-Robertson pupil, lightning pains, and ocular palsies—is quite suggestive, if not diagnostic in importance. The simultaneous existence of these four symptoms occurs in no other disease, and is positively diagnostic. The subsequent development of ataxia completes a clinical picture which is unique and is not even simulated by any other disease.

Symptoms of *tabes dorsalis* may be partially simulated by a peripheral neuritis, even without a diseased condition of the spinal cord. In cases in which peripheral neuritis is rapidly developed the following symptoms furnish the differential diagnosis of pseudotabes; very rapid progress of the disease; pain in the muscles proper and in the nerve-trunks; undisturbed pupillary reaction. Déjerine (*La Sem. Méd.*, No. 26, '93).

Twenty tabetics in which it was found that on pressure upon the ulnaris, in the sulcus ulnaris at the elbow, there was no sensation of pain fourteen times on both sides and once on one side. Considered a pathognomonic symptom of *tabes*. Biernacki (*Gaz. Lekar.*, No. 2, '94).

Marked hyperflexion of the leg at the hip-joint, without bending it at the knee, is painful in healthy subjects, while in tabetics, even during the first stages of the disease, it causes no pain. Putnam (*Boston Med. and Surg. Jour.*, Aug., '95).

The paræsthesia in the region of the trigeminus designated as "Hutchinson's mask," with a feeling as of a spider-web over the skin of the face, may be met with in the early stages of *tabes*, and is of diagnostic value. Möbius (*Neurol. Beit.*, No. 3, '95).

In many early cases of *tabes* there is insensibility to pain on pressure and on

tapping of the popliteal nerve, this symptom is more commonly present than Biernacki's sign of anæsthesia of the ulnar nerve. Bechterew (*Neurol. Centralb.*, p. 140, '98).

There is no pathognomonic symptom of *tabes*, but two symptoms are considered of value in making an early diagnosis. The first is the remarkable increase of the abdominal-wall reflex. Abdominal or other cutaneous and tendon-reflexes are antagonistic phenomena, and this antagonism may serve, in doubtful cases, as a means of diagnosis. Patients during the first period of locomotor ataxia with loss of the patellar reflex have an unusually-marked abdominal reflex, while the lack of the latter, along with increased patellar reflex, is indicative of a cerebral lesion, which causes no irritation in the neighborhood of the affected spot. The second sign is the behavior of the patient when asked to rise on his toes, with his eyes closed, and to remain standing. Those in the first period of *tabes*, with only the slightest symptoms of musculo-tonic troubles, and without any sensible alteration, are not able to execute this act. O. Rosenbach (*Brit. Med. Jour.*, Oct. 1, '98).

A peculiar brilliant appearance of the eye, which, nevertheless, is expressionless, is a valuable early sign of the disease. It is independent of the condition of the pupils, which does not modify it, and is especially easy to note in those whose irides are dark in color. Gilles de la Tourette (*Jour. des Praticiens*, Mar. 11, '99).

It is the physician's bounden duty to recognize this disease in the pre-ataxic stage. When these patients are seen in the beginning, one should not let them pass as instances of sciatica or rheumatism. People who have rheumatic diatheses, as a rule, have attacks of inflammatory rheumatism in early life. They usually get rheumatism before they reach the age of forty-five or fifty years. Rheumatism is essentially a disease of early life, and, when patients complain of aches and pains which they have diagnosed as rheumatism, one will find in the great majority of cases

they are not rheumatic at all. One sign which is not pathognomonic, but simply an aid in diagnosis, is ulnar analgesia, noted by rubbing the ulnar nerve in the ulnar notch. Along with the ulnar analgesia is very frequently found marked diminution in pain-sense throughout the whole territory. Fraenkel's sign is also an aid in diagnosis. If the thigh is extended at right angles to the body, the leg can be brought up in a perfectly straight line. The usual angle that the leg makes in that position is not manifest; the muscles are in a hypotonic condition. In other words, there is a lack of muscular tone. In very many of these cases there is an exaggeration of the abdominal reflex. D. R. Brower (*Interstate Med. Jour.*, Aug., 1901).

A diagnosis can be made with reasonable certainty if the ordinary symptoms of tabes, plus muscular weakness, paresis, spasticity and pupillary inequality, and immobility on exposure to light and on accommodation are present. Other affections with which tabes may be confounded are: Multiple neuritis, flatfoot, multiple sclerosis, and paresis. However, the differentiation of this condition from other diseases than pseudotabes seems to offer very little difficulty, unless the tabes is atypical in its development and manifestations, particularly if the differentiation is based upon a thorough physical examination. Collins (*New York Med. Jour.*, Apr. 4, 1903).

Among the diseases to be considered and which at times obscure the diagnosis, are ataxic paraplegia, disseminated sclerosis, brain-tumors, certain forms of myelitis; the syphilitic meningomyelitis of Oppenheim, Sachs, and others; multiple neuritis, and post-diphtheritic paralysis.

In the ataxic paraplegia of Gowers there is actual loss of motor function with spasticity, the knee-jerks being usually exaggerated with little if any pain, no crises, no arthropathies, and no involvement of the muscles of the eye.

In multiple sclerosis there may be ocular palsies, pains (slight) in the lower

extremities, defects of sensation, sphincteric involvement, ataxia, and even abolished knee-jerks. The knee-jerks are usually exaggerated, however; the pains differ in degree and character, and in disseminated sclerosis the peculiar speech, intention-tremor, nystagmus, and special variety of optic atrophy (Gnauck) are distinctive.

Ataxia is common in tumor of the cerebellum, the frontal lobes, and the base of the brain. Optic atrophy and ocular palsies are also frequently encountered. Attacks of cerebral vomiting may simulate the gastric crises of tabes. The clinical picture and history of focal palsies, headache, hebetude, etc., in brain-tumors serve to distinguish the two conditions quite readily. In myelitis the absence of optic atrophy, ocular palsies, and Argyll-Robertson pupil are sufficient to eliminate any element of temporary confusion. In multiple neuritis the deep reflexes are abolished or diminished, there may be much pain, and the ataxia may be decided. The rapid atrophy and true motor weakness, with altered electrical reactions, together with absence of pupillary changes, and preserved light-reflex establish the diagnosis readily. Post-diphtheritic paralysis, when it simulates, through the ataxia and sensory symptoms present, true tabes dorsalis, is a multiple neuritis, and the differential data are the same. In syphilitic meningomyelitis there is, at times, a close clinical resemblance to true locomotor ataxia. In such cases, however, motor as well as sensory defect is present, the symptoms are unilateral or at least unequal in degree on the two sides, the Argyll-Robertson pupil is not present, and prompt improvement nearly always follows the energetic use of potassium iodide and mercury.

Should the disease begin in the cer-

vical cord, it is at times difficult to differentiate locomotor ataxia from syringomyelia: a fact which has been especially emphasized by Marie. Cervical tabes is a rare form of the disease, Déjerine finding only one such primarily in one hundred and one cases at the Bicêtre.

[Psychical disturbances during the course of tabes are rather rare, but not quite so rare as is usually believed. It is necessary, in such cases, to carefully guard against confounding these disturbances with a condition of dementia paralytica combined with ataxic symptoms. H. OBERSTEINER, Assoc. Ed., Annual, '96.]

All cases of gradually-progressive blindness—if dependent upon optic atrophy and especially if occurring in negroes—should excite suspicion and lead to careful examination for the presence of other symptoms of locomotor ataxia.

Loss of the light-reaction of the pupil, with retained reaction to convergence, is the most constant symptom of tabes. Usually the pupil is somewhat smaller than normal. The light-reaction is commonly on both sides, but it is occasionally unilateral. A difference in size of the two pupils is often found. Failure in the light-reaction occurs in from 30 to 70 per cent. of all cases. Liebrecht (Deut. med. Woch., Nov., '99).

Etiology.—Heredity is of very minor importance, if, indeed, it is a factor at all in the etiology of the disease.

Mother and son, aged 51 and 27 years, respectively, both suffering from typical locomotor ataxia. There was nothing whatever to suggest syphilis either in the history or in the patients. In the mother the disease began at 31 years; in the son at 26 years of age. Other cases have been recorded in which the children of parents who had locomotor ataxia showed symptoms of the disease much earlier than in this case, but in children the diagnosis must be made with caution, as Friedreich's disease is easily mistaken for locomotor ataxia. Kalischer (Neurol. Centralb., Dec., '97).

The same is true of diathetic states, although a rheumatic predisposition may possibly favor its development. Next to syphilis, the occupation and previous habit of the individual as regards excesses, particularly physical, are most important. Railroad-employees, especially engineers, soldiers, sailors, policemen, lumbermen, drivers, and others whose work combines exposure to wet and cold, with severe physical exertion, are quite numerous among the victims of tabes. Excesses in athletic sports, in dancing, and in sexual intercourse are all considered adequate predisposing or even exciting causes when combined with syphilis.

Two cases of tabes in females who had worked excessively at sewing-machines. Guelliot (L'Union Méd., Nos. 2 to 4, '82).

Case of tabes in a woman, aged 28, without a history of syphilis or hereditary defects, who worked a double-pedal sewing-machine from morning until midnight for several years before her symptoms appeared. Bernhardt (Neurol. Centralb., Dec., '90).

Traumatism to the spine in the nature of direct violence or concussion, as from a violent fall on the feet, has been, in some instances, the only apparent cause.

Tabes traumatica is of very rare occurrence and has no characteristic symptoms. Should, however, a trauma, either alone or in combination with exposure to cold, be, under certain circumstances, the promoting cause of tabes, we should be forced to assume that, in these cases, the trauma or the cold had proved the agent inducing the formation of a poison corresponding, in its operation upon the nervous system, with the hypothetical poison of syphilitic infection. Hitzig (Fest. zur 200 Jährigen Jübelfeier, in Halle, '94).

The current view that locomotor ataxia may be caused by traumatism *per se*, irrespective of a direct lesion of the cord, is not sustained by the published evidence thus far adduced. It would seem, aside from mere coincidence, that, when a

sclerosis of the posterior columns develops after a traumatism, the subject was already doomed to this condition, the process having already begun, and that the traumatism at most only accelerated the development of the symptoms and possibly of the anatomical process. Morton Prince (*Jour. of Nerv. and Mental Dis.*, Feb., '95).

Case in which, five weeks after traumatic rupture of the thigh-muscles, pains came on in the legs; in seven months the gait was uncertain, and in a year the man was suffering from typical tabes. The patient had not suffered from any symptoms of tabes before the accident. Syphilis as well as other possible causes of tabes were excluded. In this case an ascending neuritis was probably followed by the tabes. Lammers (*Centralb. f. inner. Med.*, July 31, '97).

Cases of tabes of traumatic origin have been described by many authors, but it is by no means generally accepted that these cases are really due to the trauma. Minor's experiments on so-called nervous system concussion go to show that the symptoms of concussion are in reality due to slight lesions of the blood and lymph vessels, and the author is prepared to believe that some forms of trauma can produce like lesions in the nerve fibers themselves. He argues from these and analogous observations that tabes can and actually is at times caused by the different effects of trauma. E. von Leyden (*Berliner klin. Wochen.*, May 18, 1903).

Of all the etiological factors, syphilis appears most constantly and is unquestionably of the greatest importance. Many neurologists, indeed,—among them Möbius, Tarnowski, and others,—believe that the development of locomotor ataxia implies necessarily the pre-existence of syphilis. This is, beyond question, an exaggerated estimate of the facts, but it is also true that a history or collateral evidence of syphilis can be elicited or demonstrated in more than 50 per cent. of all cases. Erb found 89 per cent. in 300 private cases. The exact pathogen-

etic relationship is not clear. Syphilis is more than an indirect or simple predisposing factor, and yet the length of time usually elapsing between the period of syphilitic infection and the symptomatic beginning of locomotor ataxia would indicate that its action must be quite indirect. The interval sometimes amounts to thirty years or more. On the other hand, I have seen well-marked locomotor ataxia present in a patient who was at the time under energetic treatment for cutaneous syphilis, infection by senile chancre having occurred less than 18 months previously. Three years later the disease was still present, though not advancing. In 34 cases personally observed by me the average interval between the period of syphilitic infection and the first-recognized symptoms of locomotor ataxia was $9\frac{1}{2}$ years.

Of 500 cases of tabes 10.8 per cent. were not infected and 89.2 per cent. were infected with syphilis. Of 50 additional cases, from the lower classes, 12, or 24 per cent., did not show evidence of infection, while 38, or 76 per cent., did.

Concerning other possible etiological causes, or combination of causes, the cases are grouped as follows: Syphilis alone, 27 per cent.; syphilis and cold, 11 per cent.; syphilis and fatigue, 6 per cent.; syphilis and sexual excesses, 9.6 per cent.; syphilis and trauma, 1.7 per cent.; syphilis and neuropathic tendencies, 12 per cent.; syphilis, cold, and fatigue, 13.5 per cent.; syphilis, cold, and excesses, 1.7 per cent.; syphilis, fatigue, and excesses, 0.7 per cent.; syphilis, trauma, cold, or excesses, 1 per cent.; neuropathic tendencies alone, 0.7 per cent.; cold alone, 1.4 per cent.; fatigue, 0.3 per cent.; sexual excesses, 1 per cent.; cold and fatigue, 0.7 per cent.; trauma, 0.3 per cent.; several causes, but not syphilitic, 1.4 per cent.; cases without demonstrable cause, but in several of which syphilis was suspected, 5.4 per cent. Erb (*Practitioner*, Sept., '91).

Of more than 400 cases of tabes, in

about 90 per cent. there was a previous history of syphilis. Gajkiewicz ("Syph. du Sys. Nerv.," '92).

[The first symptoms of tabes only occur several years after syphilitic infection, most frequently from the sixth to the tenth year; only very rarely does tabes show itself in the florid stage of syphilis. H. OBERSTEINER, Assoc. Ed., Annual, '93.]

In Japan syphilis is very wide-spread, while tabes but seldom comes under observation. Grimm (Inter. klin. Rund., Aug. 29, '94).

Tabes is a "disease of exhaustion" of the spinal cord, referable to a disturbance of the nutrition of the cord, induced by some noxious agent (notably syphilis). Edinger (Volkmann's Samml. klin. Vort., No. 106, '94).

From a study of the reports of the neurological section of the Charité Hospital, Berlin, it is found that syphilis positively existed previously in 37 per cent. of the cases, most probably in 31 per cent., and possibly in 7 per cent. Kuhn (Inaug. Dissert., '94).

There was personally found under the guidance of Leyden, who still denies the etiological significance of syphilis for tabes, among 108 cases, only 20.4 per cent. which were undoubtedly syphilitic and 58.3 per cent. non-syphilitic. Storbeck (Lyon Méd., '95).

Although syphilis could be proved in about 55 per cent. of 225 cases, in many of them it was associated with other causes of tabes dorsalis,—as hereditary joint-affections, alcoholism, sexual excess, etc.; so that the exact percentage which could safely be attributed to syphilis was reduced to 22.33 per cent. Pitres (Lancet, Apr. 13, '95).

In non-tabetic patients above the age of eighteen a history of syphilis was found in only 22.5 per cent., whereas in tabetics it reached 72.8 per cent. There is a close connection between syphilis and tabes; tabes is a consecutive affection to syphilis, somewhat similar to the paralysis which may follow diphtheria. Sarbo (Pester. Med.-chir. Presse, xxxiv, 3 to 5).

A cause which enters as a possible factor in producing locomotor ataxia is the

long-continued and uninterrupted administration of large or even measureably large doses of iodide of potash, which is so commonly given at the present day in the treatment of syphilis. C. T. Drennen (Alienist and Neurol., Oct., '96).

The idea is rapidly gaining ground that locomotor ataxia is in no case, perhaps, directly due to syphilis, but to the action of some other poison or poisons, the development or activity of which is favored not only by the presence of syphilitic poison, but by other conditions whereby a morbid state of the body is induced and the resistance of the tissues diminished. Editorial (Modern Med. and Bact. Review, Apr., '97).

Although syphilis is exceedingly common among negroes, after more than a decade's practice no case of locomotor ataxia seen. C. S. Briggs (Atlanta Med. and Surg. Jour., Nov., '97).

The previous history of 47 cases of tabes carefully examined, and in only 8 cases could the writer find no history of syphilis, and in 3 of these preceding syphilis was probable. In 32 cases there was a very definite history of syphilis, and, of these, 10 were only treated for syphilis for a short time early in the disease. In 21 cases there had been a second course of treatment, and in only 1 case had there been repeated intermittent treatment, and then for only one and a half years. In some cases of tabes, when actually established, an antisyphilitic treatment may be of service. Homen (Neurol. Centralb., p. 1026, '97).

Examination of 257 cases of tabes, tending to prove that syphilis is a cause: (1) on the statement of the patient, based on a doctor's opinion; (2) on the former presence of an ulcer with secondary symptoms; (3) on the presence of an ulcer of undetermined character, but followed by secondary symptoms. Cases with a history of soft chancre are put into a separate group. Of the 257 cases (including three women), there was certain syphilis in 38.9 per cent., probable history in 19.8, and a history of soft chancre in 5.8. In 34.2 per cent. syphilis was the only apparent cause. Generally tabes commenced between the fifth and tenth years after infection, and fairly

often between the tenth and twentieth years. Tumpowski (*Deut. Zeit. f. Nervenhe.*, x, '97).

In a series of 61 cases a history of syphilis was given in 31 of 49 cases examined. In the other 18 there was evidence of possible exposure to the disease. In the remaining 12 syphilis was either denied or the point was not determined. In most of the cases the initial symptoms of ataxia appeared in from eight to fifteen years after syphilis had developed. In 2 cases the disease followed soon after mechanical injury. A history of exposure to wet and cold was given in 7 cases; 1 case developed immediately after typhoid fever. In 29 cases the disease first appeared between the ages of thirty and forty. In 2 cases it began at the age of 25, and in the 1 following typhoid fever at 22 years. In 37 cases the initial symptom was pain in some part of the body, usually described as rheumatic. In 3 cases it was gastric crises; in 3 cases laryngeal crises; in 4, inco-ordination of the lower limbs. W. H. Riley (*Jour. Nerv. and Mental Dis.*, Sept., '98).

Following facts mentioned as antagonistic to the syphilis theory of tabes: 1. The rarity of tabes dorsalis among the Kirghiz of Central Asia, despite the fact that syphilis is very common. 2. Syphilis is common among negroes, but tabes is almost unknown. 3. In Bosnia and Herzegovina syphilis is extremely common, but tabes rare. This is true also of Abyssinia. Among the Arabs, despite the frequency of lues, general paralysis is rare. Tabes is also rare among prostitutes, although most of them are syphilitic. S. H. Scheiber (*Deut. med. Woch.*, Sept. 22, '98).

Of 111 cases analyzed, 106 were in whites and 5 in negroes: a percentage of only 4.5. This difference is of interest when the question of relation of syphilis to tabes, admitted by the majority of authors, is considered. Syphilis is very common in the negro: $5\frac{1}{2}$ times as frequent in men of the black race as in men of the white. Notwithstanding this, tabes is rare in the former. Conclusions regarding the relation of syphilis to tabes are: (1) in a large propor-

tion of cases of tabes a history of syphilis can be obtained; (2) in a certain, not inconsiderable, number there is no history of venereal sore or other syphilitic manifestation; (3) in negroes tabes is relatively common, whereas syphilis is very much more common in them than in white persons; (4) the partial immunity of women is greater than can be satisfactorily accounted for by the relative infrequency of syphilis among them. H. M. Thomas (*Bull. Johns Hopkins Hosp.*, Apr., '99).

In Japan, where syphilis has scourged the population for thirteen hundred years, locomotor ataxia is unknown. In a venereal clinic of ten thousand cases not a single case of locomotor ataxia was found, while none of the native physicians asked knew of such a disease as "tabes." A. S. Ashmead (*Jour. Amer. Med. Assoc.*, Sept. 2, '99).

In 100 consecutive cases of tabes unquestionable evidence found of past syphilis in 68. In 12 per cent. the disease was probable; in the remaining 20 per cent. the disease was possible; that is, there had been exposure to the ordinary reasons of infection. All these cases occurred in males. In the case of women the facts are more difficult to obtain, but evidence of syphilis is clear in at least half of the cases, and the remainder are for the most part in married women in whom the disease is hard to prove. W. Gowers (*Brit. Med. Jour.*, Dec. 9, '99).

It is probable that there is some common cause of tissue-inferiority, and that the underlying factors are congenital predisposition and functional exhaustion. There is no practical therapeutic value in upholding the theory of syphilis. D. F. Wolfstein (*Cincinnati Lancet-Clinic*, Feb. 24, 1900).

Various theories as to the origin of locomotor ataxia. Gowers assumes it is an inherent weakness of the neuron, an abiotrophy of those cells and an inherent condition; or an acquired weakness brought about by excess known to be injurious to highly developed nerve-substance and by mental and physical fatigue, particularly the latter. Others maintain that exposure, chilling, or in-

jury are the causative factors that alter the resistance of the sensory neurons, so that the real cause of the disease may become operative. Personal cases do not support these views; the disease occurs in civilized mature men and women who have had syphilis and in children who inherit syphilis. Joseph Collins (*Medical News*, Jan. 3, 1903).

The factors of age and sex are of interest. The disease is one rather peculiar to the period of virile manhood, the years between 25 and 45 showing, by far, the largest number of cases. True locomotor ataxia rarely, if ever, occurs in childhood.

Ten cases of true tabes in childhood. In six cases the disease began before the tenth year, and in four between the tenth and fourteenth years. In the majority of cases hereditary syphilis was not indicated. Hildebrandt (*Ueber Tabes Dorsalis in Kindersalter*, '92).

Males are more liable to the disease than females in the ratio approximately of 10 to 1. Climate and race are unimportant factors, though, in my personal observations, out of 34 cases, 14 were Irish or Irish-Americans. The negro has been considered heretofore as rather peculiarly exempt from posterior spinal. This exemption, it seems, is apparent rather than real, at least in large degree, the disease probably occurring much oftener in the negro than hitherto supposed, but escaping recognition because of the anomalous clinical form—amaurotic tabes—in which it appears in this race. McConnell has recently published the records of five cases of tabes in pure-blooded negroes—the only cases observed in negroes in eight years' service at the Philadelphia Polyclinic, all of whom exhibited the amaurotic type.

Statistics of 1642 cases of nervous disease of all kinds, there being 496 male and 264 female Russians; also 449 male and 433 female Jews. Among the male Russians 25 per cent. were syphilitic, and

among the females 11.4 per cent.; among the Jews only 7 per cent., and among the Jewesses only 1.5 per cent. Among the Russians of both sexes the proportion of tabes was five times greater than among the Jews. Minor (*Neurol. Centralb.*, July 1, '92).

Study of 286 cases of tabes dorsalis admitted to the Vanderbilt Clinic under M. Allen Starr during thirteen years. Seventy per cent. may be regarded as the true proportion of cases of tabes dorsalis with a history of previous syphilis, as against 80 per cent. as given by Gowers (1886), 90 per cent. by Strümpell (1889), 88 per cent. by Erb (1881), 90 per cent. by Rumpf (1887), and 91 per cent. by Fournier (1882). In syphilitic cases the time which elapsed between the appearance of the chancre and the onset of tabes dorsalis varied from one to forty years according to the detailed histories obtained from 57 cases. Among other etiological factors were alcoholism, undue exposure to heat and cold, and traumatism. Sexual excess was also present or was alleged to be a cause in 1 case and articular rheumatism in another. Allan Bonar (*Jour. Med. and Ment. Dis.*, May, 1901).

Examination of 42,664 cases; 3.53 per cent. or 725 men were tabetic, while but 1.31 per cent. or 288 women were tabetic. The proportion of male to female tabetic is therefore greater than the sex proportion in paretic dementia. Among the well-to-do classes the condition was somewhat reversed, the proportion being 25 to 1. Sterility was exceedingly frequent among female tabetics. E. Mendel (*Neurol. Centralb.*, Jan. 1, 1901).

Pathology.—Ordinarily the gross macroscopical appearances observed post-mortem in this disease are both conspicuous and constant. The cord is flattened antero-posteriorly from shrinkage in the posterior columns, which are also unnaturally gray in color. Microscopically the nerve-tissue proper is found to be sparse or to have almost completely disappeared in certain localities, its place having been taken by an overgrowth of connective tissue. The area most affected

is that of the lumbar enlargement and lower dorsal region, and the fibres which exhibit the greatest damage and destruction are those of the columns of Gall and Burdach and the Spitzka-Lissauer tract. Higher up, and as the disease advances, similar changes are noted in Clarke's vesicular tract. Gowers's sensory tract in the antero-lateral field is quite often involved and sometimes quite early. Less constantly the direct cerebellar tract shows similar degenerative changes; but implication of the crossed pyramidal fibres or Turck's columns occurs only as a complication.

In the early development of tabes dorsalis, there is a general syphilitic inflammation of the meninges, whereby some of the sensory or motor roots are attacked on leaving the sub-arachnoid space. The changes implicate first the root fibres in the posterior columns of the cord, and later the roots outside the cord. The process begins in the neurons within the cord, and progresses outward toward the trophic centre in the intervertebral ganglion. The process is a slow one, and attacks only the posterior roots and certain fibres in each root. The parenchyma of the cord is also implicated; the pia mater is thickened with cellular infiltration and changes in the vessels, especially the veins. These changes result eventually in sclerosis. Najesth (*Presse Médicale*, Jan. 3, 1903).

The posterior roots and ganglia are also involved, sometimes quite extensively. If the disease has been of long duration and has reached the paralytic stage, the anterior gray horns are apt to show degenerative changes in both fibres and cells.

Destruction more or less complete of the nerve-elements in the posterior horns is quite often apparent microscopically. Autopsies have been reported from time to time in which extensive degenerative disease of the peripheral nerve-fibres or

neuraxons has been noted, but such peripheral changes have been considered, until recently, as of secondary rather than primary importance. Pathogenetically the disease has been considered as primarily of vascular origin, an exudation of lymph leading to a proliferation or neoplastic infiltration of the neuroglia or connective tissue, with consequent compression and, ultimately, structural disintegration of the nerve-fibres. This represents a *résumé* of the older and hitherto-accepted teachings as to the pathology and morbid anatomy.

Recent methods of pathological research with the correlated studies in this field of Cajal, Van Gehuchten, Marie, Redlich, Hodge, and others have, however, brought to light facts which demand modifications of these views so radical as to be almost revolutionary. The exact pathogenesis of tabes is as yet an incomplete chapter in the history of this disease, but enough has been proved to demonstrate that it is *not* a primary sclerosis of the posterior columns. The recognition and acceptance of the theory of the neurons was an important step in establishing this fact. According to the newer teaching, the disease is a centripetal parenchymatous atrophy or degeneration of sensory neurons followed secondarily by sclerosis, due to nutritional disturbances, which, according to Marie, affect first the ganglia on the posterior roots.

These ganglia, it will be remembered, are the trophic centres, not only for the sensory nerves, but for the neuraxons, or axis-cylinder processes, of the dorsal columns of the cord. The neuron of the posterior spinal ganglia is a flask-shaped body, having an axis-process, or neuraxon, which divides into two branches, one of which passes within the nerve-sheath to the periphery, forming an ar-

borized or brush-like net-work of distribution in the skin or muscle-spindles. The other branch passes, with the posterior root, into the cord, dividing there into two branches, one of which ascends, while the other descends, in the posterior column. From both of these branches smaller fibres are given off which terminate in the posterior-horn gray matter. Some of these smaller fibres are short, others quite long, extending as far as the medulla, where they end in terminal arborizations. Marie divides these fibres into three sets:—

1. Short fibres which pass directly into the posterior horns after entering the cord.

2. Fibres of medium length which run upward in the cord, some of them ending in the middle posterior horn, others passing into Clarke's column. These fibres are contained in the fasciculus cuneatus of Burdach.

3. Long fibres coming chiefly from the roots of the cauda equina, passing thence the full length of the cord to the medulla and forming the fasciculus gracilis of Gall.

Marie's theory is as follows: "The changes found in the tabetic spinal cord are not the result of a primary systemic myelopathy; they are the expression of a progressive degeneration of the posterior-root fibres; these medullary changes in tabes occur in segments, while each diseased posterior root furnishes a new contingent of degenerated fibres to the spinal cord." The initial cord-lesion is found in the dorsal-root zone and the Spitzka-Lissauer tract, due, Marie believes, to degeneration through the medium of the short (1) fibres. The degeneration in the columns of Burdach and Clarke's columns, which is usually proportionate in degree to the duration of the disease, occurs through the medium of the fibres

of the second group. The sclerosis observed in the columns of Gall he attributes to the degeneration of the long fibres of Group 3. Primary disease of the ganglia of the dorsal roots affords the explanation for the peripheral neuritis, which is parenchymatous and not interstitial, and is the result of disease of the trophic centre of the peripheral nerve in the posterior ganglia. Marie, while maintaining this view, most strenuously admits that no evidence whatever of disease of the spinal ganglia is found in some cases, but it is quite possible to assume that very subtle and slight trophic changes at this point, although unrecognizable, are sufficient to produce the changes in the distal arborizations of the sensory neuraxons in the muscle-plates and skin, and in the cord which are farthest removed from their nutritional centres, which changes give rise to the lightning pains, the diminished knee-jerks, pupillary changes, the vesical and sexual symptoms, and other sensory and trophic disturbances which mark the incipient stages. The studies of Déjerine, Wallenberg, Rousoni, Blocq, Trepinski, Obersteiner, and Redlich, as well as the very interesting and important observations of Sherrington, Batten, and others as to the relations in health and disease of the distal-nerve arborization in muscle-plates and muscle-spindles to the muscular sense and its perversions, are all distinctively corroborative of this theory.

The relationship of syphilis etiologically occurs, according to the views of Obersteiner and Redlich, through the presence of thickening of the pia, from old leptomeningitis presumably, which, by compressing the dorsal-root fibres at a point of lessened resistance, leads to their degeneration. Further discussion of this very important subject, while exceedingly interesting, would be without pres-

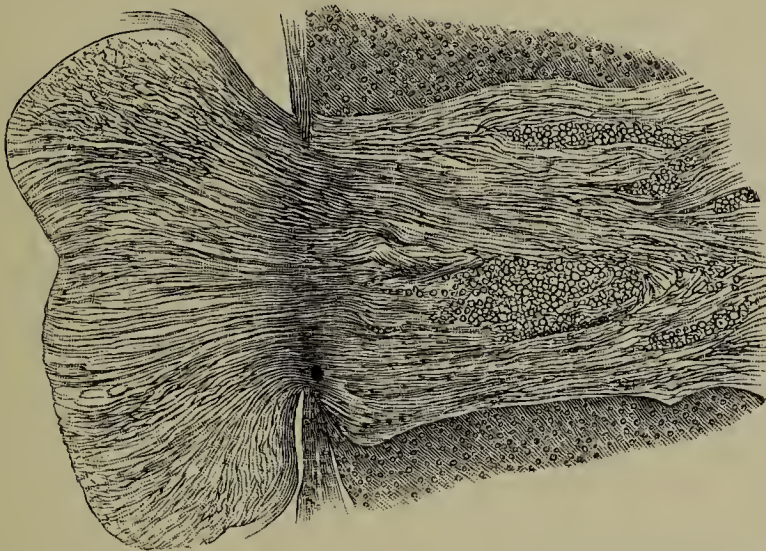
ent advantage in the absence of further proof, which is needed before a final acceptance of these views in their entirety is admissible.

The causative condition of tabetic disease of the spinal cord is to be found in a compression of the posterior roots, at their point of penetration into the spinal cord, with consecutive ascending degeneration of their intramedullary prolongations. Obersteiner and Redlich (*Arbeiten aus den Inst. f. Anat. u. Phys. des Centralnerv. in Wien*, '94).

Pathological changes demonstrated in the cerebellum in all of the six cases of tabes personally examined—for instance,

meninges, where the dura mater and arachnoids lie closely against the pair of roots, in funnel shape, inclosing the same as far as the spinal ganglion. At this point in tabes is found a perineuritis with nuclear proliferation and consecutive sclerosis. This occasions a circular tightening of the roots by which these, and particularly the posterior roots, are very much injured. Nageotte (*Bull. de la Soc. Anat.*, Nov. 16, '94).

Changes found by Nageotte frequently occur in tabes at the point indicated, but they are of no importance as far as the degeneration of the posterior roots is concerned, since the latter show the same degree of degeneration, both in front of and



View of a normal posterior lumbar root at its point of entrance into the spinal cord. At the spot where the root is tightly compressed by the pia mater it appears darker, while the medullary sheaths are much thinner or are totally absent. (*Obersteiner.*)

atrophy of the nerve-cells in the corpus dentatum and degeneration of the medullary fibres in the lobules. Tellinek (*Deut. med. Zeit.*, Mar. 26, '94).

[Degeneration of the spinal trigeminus root in tabes is not by any means rare, and the ascending root of the glossopharyngeus nearly always degenerates simultaneously. H. OBERSTEINER, *Assoc. Ed.*, Annual, '95.]

There is a constriction or snaring of the posterior roots by a process which may be termed inflammatory, causing degeneration of the posterior columns; but the point of the tightening pressure, however, is not established at the spot where the root extends through the pia mater, but rather at the passage of the outer spinal

behind this point, in a longitudinal section. Obersteiner (*Arbeit. a. d. Inst. f. Anat. u. Phys. d. Centralnerv.*, No. 3, '95).

The condition of tabetic arthropathies is one of trophic degeneration without inflammation. Parker Syms (*N. Y. Med. Jour.*, Jan. 19, '95).

The lesion of tabes has its origin in the posterior roots just at their point of union with the cord. This is anatomically a *locus minoris resistentiæ*; what precise exciting cause of the change is has to be decided. Redlich (*Die Pathol. der Tab.*, *Hinter. ein Beit. zur Anat. und Pathol. der Rucken.*, p. 6, 205, Jena, '97).

Tabetic processes classified as interstitial and parenchymatous. The former is regarded as entirely secondary to the

latter, which is the primitive change. It affects the posterior roots and posterior columns, but leaves the intervertebral ganglia intact. The change affects the myelin sheath, bringing about a segmentation and granular degeneration, resulting in atrophy. The nuclei of the nerves are not multiplied, but the exact condition of the axis-cylinder was not determined. It probably remains more or less intact for a long time. The evolution of tabes follows two types: the benign and the grave. In the latter the lesion is in the cord, resulting in very rapid destruction of the endogenous zones of the posterior columns, both ascending and descending. In the former, on the other hand, the lesion is in the posterior roots, outside the cord, and has little tendency to spread. It is these that especially exhibit pains, while numbness and tingling indicate rather an affection of the cord. Philippe (*Arch. de Neurol.*, Sept., '97).

In locomotor ataxia there is a lowered vitality of the nervous apparatus, inherited or acquired, resulting in defective nutrition of the neurons. The neurons are the first to exhibit signs of malnutrition in parts farthest removed from their affected nutrition-centres in the posterior spinal ganglia, viz.: the cutaneous spinal-cord arborizations, respectively. Mettler (*N. Y. Med. Jour.*, Oct. 15, '98).

Tabes is characterized anatomically by an inflammatory lesion which attacks any number of sensory or motor roots, where they leave the subarachnoid space, accompanied with a generalized syphilosis of the meninges. Tabetic degeneration is mainly a progressive destruction of posterior roots, moving from the extremity of the neurons in the spinal cord toward the trophic centres in the ganglions of the roots. While all the fibres in a bundle are not equally affected, the affection is always a slow, progressive atrophy. The anterior roots do not escape. The meningitis found is typically syphilitic, the vessels always showing alterations. Diffuse syphilitic meningo-myelitis, like lymphocytosis, is found in all the clinical forms of nervous syphilis. The minute histological changes found are described. There is always radicular

neuritis in tabes dorsalis. J. Nageotte (*La Presse Méd.*, Dec. 10, 1902).

Complications.—Locomotor ataxia is quite frequently encountered in association with general paresis. Either of the two may appear as the primary disease, the other occurring in such cases as a complication. Hemiplegia is also not very uncommon. Through an extension of the disease-process other areas of the cord may be involved, and symptoms of lateral sclerosis, progressive muscular atrophy, etc., may be added to the original picture. Phthisis, heart disease, and nephritis are occasionally found co-existent, though not in any essential relationship.

In a male patient the very unusual combination of tabes with paralysis agitans noted. Placzek (*Deut. med. Woch.*, July 7, '92).

A typical case of tabes in which, with the sudden appearance of hemiplegia on the left side, there were also pronounced symptoms of paralysis agitans. Raichline (*Jour. de Méd.*, July 28, '95).

Dementia paralytica and true tabes are only rarely combined, but the former affection may begin with spinal symptoms which simulate tabes; it is then merely a pseudotabetic process with a different condition in the spinal cord. Joffroy (*Nouv. Icon. de la Salpêtrière*, No. 1, '95).

Exophthalmic goitre and diabetes have also been observed.

The association of exophthalmic goitre with tabes is more than a mere coincidence. It is due to bulbar disturbances, possibly from congestive hyperæmia. Marie (*La Sem. Méd.*, Dec. 19, '88).

Two cases in which tabes was combined with Basedow's disease. Thimotheeff (*Thèse de la Faculté de Paris*, '93).

In a case of tabes combined with Basedow's disease there was found degeneration of the ascending roots of the trigeminus and of the glosso-pharyngeal nerve. Marie and Marinesco (*Revue Neurol.*, May 30, '93).

The relation existing between tabes and diabetes may vary in character; dia-

betes being present, certain symptoms of tabes may occur, or during the course of tabes sugar may appear in the urine. There is, besides, relation between true tabes and true diabetes, through the fact that these diseases occur in various persons of the same family, in consequence of an hereditary nervous taint, both appearing at times in the same subject. Blocq (*Revue Neurol.*, Apr. 30, '94).

Prognosis.—The disease has been heretofore considered essentially chronic and progressive and the prognosis as regards cure extremely unfavorable. The degree to which the newer discoveries and correlated teachings in pathology will modify this conclusion has not yet been fully determined. It can, at best, affect the prognosis favorably only when the disease is recognized and properly treated promptly and in its incipency. Well-established locomotor ataxia will, in all probability, remain, as heretofore, a chronic progressive practically incurable affection.

The duration of the disease is very variable, extending over a period from twenty to thirty years in some instances. It is rarely the cause of death *per se*, a fatal termination occurring usually through the medium of some intercurrent affection, such as cystitis, pyelitis, trophic disorders, hypostatic pneumonia or bronchitis, or a profound asthenia.

Much in the way of symptomatic relief may be promised from intelligent treatment, and in some cases long periods of arrested progress may be obtained. Coordination can be materially improved and the pains and crises relieved. Spontaneous amelioration of symptoms may occur and spontaneous remissions in the progress of the disease have been frequently noted, but such results are much more positively assured from treatment. Usually the pains tend to become progressively less as the disease advances, the explanation being obvious in a progressive diminution in sensory function.

Less easy of explanation, but none the less a fact, is the lessening and sometimes marked improvement in the ataxic and painful symptoms which attends the onset of blindness. The greater amount of rest—enforced rest—affords a probable partial explanation. The development of severe trophic symptoms is an omen of evil and may be the precursor of the end. Pseudoparalytic or actual paralytic helplessness may develop in the late stages and superinduce a fatal asthenia. Cases with well-marked and frequently-recurring crises, especially gastric, cardiac, and respiratory, are said to run a shorter average course. The etiological element in individual cases does not apparently modify the prognosis to any appreciable extent. Freedom from want and worry, on the other hand, are materially advantageous to the possessor who is a victim of this disease. In my personal experience, which is, however, insufficient for positive deduction, the disease runs a far more rapid course in women than in men.

Syphilis does not play the important part usually assigned to it in the causation of tabes. Other infections and intoxications or simply physical or moral shock, mental strain, or privation must be considered as etiological factors in the disease. Though the majority of tabetics have suffered syphilitic infection, the symptoms of tabes first appear in many such subjects after other infections and intoxications. It may be said that in 60 per cent. of the cases, no matter what the treatment, tabes is arrested in the early stages; or its evolution is so slow that its effect upon the duration of life is very slight. In but 30 per cent. does the disease progress so rapidly as to justify the grave prognosis formerly given in this condition. Five per cent. of the cases are clinically cured, while a like number progress rapidly and fatally, and their course is marked by fever and symptoms of infection. This febrile form of tabes has

not hitherto been described, and runs a short course of a few months to two years. M. Faure (*Jour. de Méd. de Bordeaux*, Aug. 16, 1903).

Treatment.—There is no specific known to be effective in curing locomotor ataxia, and this is true even of the cases positively due to syphilis. Iodide of potassium and mercury in various forms alone or in combination have proved equally inefficient, at least as regards anatomical cure, though, occasionally, in acute cases especially, an arrest of progress has been attributed, and probably correctly, to these agents. In cases in which, by intuition or good fortune, rather than by applied diagnosis, the disease has been recognized in its very incipency, the prompt and proper administration of either of these drugs might prove positively curative and is certainly worthy of employment. The uncertainty of diagnosis would, however, render conclusions as to the curative value of these drugs at least a problem.

The idea that antisyphilitic treatment in tabes is useless or even hurtful is erroneous. Personal improvement of one or several symptoms found in fifty-eight of seventy-one cases of tabes, after the use of mercury; there were no results in eleven cases, and only in two did aggravation of the symptoms occur. Heidelberg (*Berliner klin. Woch.*, Nos. 15, 20, '93).

Leredde holds both tabes and progressive paralysis to be curable by active mercurial treatment, but in some of the cases he gives the presence of tabes appears to be doubtful, while in others its onset has followed quickly on syphilis. Lejeune supports Leredde, and even regards paralysis as more amenable to treatment than tabes. P. J. Möbius (*Jahr. der in. u. ausland. Gesem. Med. Ht. i*, Jahrgang, 1904).

Although many observers have failed to obtain encouraging results with anti-syphilitic treatment, Erb strongly recommends it. One is able to cure, or at

all events to improve, tabes by an anti-syphilitic treatment, and by the same means the writer has succeeded in arresting the progress of well-marked disease. In no case has he seen any harm follow from the treatment, while in many it did undoubtedly good. Some cases were not influenced by it, which the author ascribes to the late date at which the treatment was begun. In support of his view that a mercurial inunction treatment does actual good, some details of a number of cases are given which were treated in this way. In all these he has had the advantage of consulting with either Erb or Hoffmann prior to applying the treatment. The account of many of the cases is striking, showing that when the treatment was discontinued for other forms of treatment the improvement which had been attained disappeared until the inunction was again resorted to. E. Coester (*Berl. klin. Woch.*, July 4 and 11, 1904).

There is little if any evidence in clinical experience tending to confirm the claims advanced as to the curative merits of the salts of silver and gold, of ergot, of arsenic, or of the many other vaunted specifics which appear in the older literature of this disease.

In case of tabes an injection of Koch's tuberculin was given, and repeated in two days; the treatment followed for three weeks. Pains were increased at first, then rapidly diminished, until, at the end of three weeks, they had entirely gone. Co-ordination was much improved, and his strength greatly increased. Another case showed great improvement under similar treatment. Neilson (*Med. and Surg. Reporter*, May 30, '91).

Plea for the cold-water treatment of spinal diseases. Cold affusion to the lower extremities is of value, these parts having been previously warmed by the hot pack or by steam-baths. The cold should not be applied for more than a minute, after which the parts are dried and covered for half an hour with dry blankets. This treatment has proved especially efficacious in tabes. R. von Hoesslin (*Balneol. Centralb.*, Oct. 16, '91).

In locomotor ataxia lukewarm baths, with pine-needle extract, or half-baths with affusion, are indicated. Hot sand- or water-bags are sometimes applied continuously to the spine for one or two hours, with the purpose of increasing the temperature and circulating activity of the cord. Dana (*Dietetic Gaz.*, Dec., '91).

Phosphate of sodium used in a number of cases with surprising results. A solution of $1\frac{3}{4}$ grains of the salt in $15\frac{1}{2}$ minims of cherry-laurel water is injected close beside the lumbar vertebral column. According to the severity of the disease, one or two injections are made daily. After twenty-five applications the improvement is very noticeable, and after fifty very pronounced. Forbes Winslow (*Lancet*, Nov. 18 *et seq.*, '93).

Santonin in three doses of 5 grains ($\frac{1}{3}$ gramme) at three-hour intervals in 11 patients experimented on gave relief in 8, temporarily relieved 2, and did not affect 1. The routine of giving 10 grains ($\frac{2}{3}$ gramme) as an initial dose and 5 grains ($\frac{1}{3}$ gramme) five hours later was adopted. The santonin was administered in the crises only. The pain was relieved in from two to three hours after the initial dosage. E. Negro (*Gior. della Reale Accad. di Med. di Torino*, Feb., 1901).

The method of suspension, while effective in exceptional instances in modifying, at least, temporarily, certain obtrusive symptoms, has not survived the test of time, and, indeed, is to-day condemned as often positively harmful.

The lancinating pains and crises occasioned by the pressure upon the nerve-roots and even the transitory improvement caused by suspension and nerve-stretching, are explainable through the fact that the tension brings about a loosening of the compressed, swelled connective tissue. Obersteiner and Redlich (*Arbeit. aus den Inst. f. Anat. u. Phys. des Centralnerv. in Wein*, '94).

Suspension considered as a useful measure in a number of cases; certain symptoms are improved, as, for instance, pains, sexual weakness, and incontinence. De Forest Willard and Guy Hinsdale (*Med. News*, Nov. 24, '94).

Case of a tabetic patient who was obliged to use a wheel-chair; suspension was resorted to every other day during a long period (several years). After from fifteen to eighteen months he was able to walk with two canes, and after three years he could walk alone, play croquet, etc. The bladder and rectal symptoms also disappeared under this treatment. Hugh Cuthbertson (*Canadian Pract.*, Nov., '94).

The following points given as the chief aim in the treatment of tabes: Active antisyphilitic treatment if the indication exists, the use of tonics, and electricity; hydrotherapy in its various tonic forms, the use of electrotherapy and suspension, care being taken not to neglect symptomatic treatment. Later, if the indications still exist for active antisyphilitic treatment it is to be used, although such good results cannot be expected from it. Careful regulation of the diet should be insisted upon, and hydrotherapy, electricity, with gymnastics, suspension, and psychical treatment should be utilized. If the disease is very far advanced and the patient is much incommoded in his movements, it is important to maintain his mental tone by every encouraging method that one possesses, and to use medication which will combat the disagreeable or painful symptoms. Erb (*Revue de Thér.*, May 1, '97).

By causing a sitting patient to bend forward strongly with the hands outstretched, a true strong elongation of the spinal cord to the extent of about $\frac{2}{3}$ inch takes place, and this elongation occurs mostly in the lumbar region. The writers have, therefore, constructed an apparatus so that the bending may be brought about forcibly without interfering with the breathing or circulation. It was tried in the second stage of the disease, in thirty-nine men and eight women; cases of very long duration were excluded as well as cases of very rapid onset, or if in the third or paralytic stage. Good results were obtained in half the cases; the sensory irritations and lightning pains were improved, retention of urine was relieved, but incontinence was less influenced. Almost always the gait improved, and ten patients were able to

walk again alone; on the eyes and bulbar symptoms the stretching had very little influence. Ten patients were not benefited. Each stretching was kept up for eight or twelve minutes, and repeated fifteen to twenty times. Improvement showed itself mostly at the tenth to the fifteenth sitting. The treatment was never continued for longer than three or four months or forty to fifty sittings. Gilles de la Tourette and Chipault (Prog. Méd., p. 278, '97).

In the treatment a favorable impression was gained from the use of large quantities of water for purposes of flushing out the system. Patients are instructed to drink from 5 to 7 pints of water daily. Hydrotherapy, especially warm baths, electricity, massage, and other mechanical movements, including suspension treatment, are valuable. W. H. Riley (Jour. Nerv. and Mental Dis., Sept., '98).

There is no therapeutic agent of so much value in successfully combating the degenerative processes, and in raising the vitality of the diseased parts and of the entire body, as hydrotherapy. Extremes in temperature as well as excessive corporeal exercises are to be avoided. Dudley Fulton (Jour. of Nerv. and Mental Dis., April, 1902).

The therapeutic life of the animal extracts in this disease was equally short and inglorious. In the absence of any specific our efforts are limited to two indications: the retardation in progress of the disease and the palliation or control of symptoms. Much can be done in both directions. Three remedial measures stand out conspicuously in a host of failures as having a certain and established value. These three are rest, electricity, and the Frenkel method of "re-education." Conjointly and intelligently employed, the results are positive and at least relatively satisfactory. The degree of rest necessarily varies. In the incipient stage the severity and frequency of the pains and other sensory symptoms should be the guide. Five or six weeks

of absolute rest in bed is ordinarily sufficient. The return to active exercise should always be tentative and gradual and for months or even years the amount of physical exercise should be carefully guarded. Any evidence of an aggravation of the disease should be interpreted as a danger-signal, demanding a return to absolute rest. In the ataxic stage the same rule should apply, though with less rigor perhaps, since the results to be obtained are less important. I have seen the pains, the ataxia, the disturbances in sphincteric control and the various crises either greatly lessen in severity or entirely disappear from prolonged absolute rest. Next in order to rest is galvanism. Of the value of static electricity I have no personal knowledge. Faradism in my experience is quite often and perhaps always positively harmful. Galvanism should be employed daily. The current should not exceed at first 5 milliampères. The *séances* should at first be limited to ten or twenty minutes, gradually lengthened to one or even two hours, daily. The electrodes (Erb) should be applied to the spine, thoroughly wet, of course; one over the upper dorsal region, the other over the upper sacral spine. The selection of the pole is immaterial in my experience. Occasionally it is of advantage, if the pains are severe or the ataxia of station or gait extreme, to apply the electrodes one under the sole of each foot, the current making the direct circuit of the nerves chiefly affected.

A rest treatment may be essential for the best results in a stubborn advancing case. Such patients should never exercise to tire, and should be in the fresh, dry air much, especially at great altitudes. Massage and electricity properly applied are most valuable. The use of a stimulating liniment rubbed well over the surface of the body has proved also of great value in stimulating circulation.

The following may be used:—

- R Ammonium chloride, 3 drachms.
- Glycerin, 1 ounce.
- Tincture of capsicum, $\frac{1}{2}$ ounce.
- Peppermint-water, q. s. to make 12 ounces.

M. Rub on the body daily for twenty minutes, with massage. Savary Pearce (*Therap. Gaz.*, Oct. 15, '98).

More than one-half the cases of locomotor ataxia may be almost completely arrested in the incipient period of the disease, and nearly all are more or less amenable to treatment, if this is instituted before the patient becomes greatly exhausted, or before he has to take to his bed. J. T. Eskridge (*Charlotte Med. Jour.*, Dec., '98).

Special massage for each case of tabes recommended, since harm will result unless practiced exactly as directed. Massage of the skin is of value for quieting sensory disturbances, and acts as a tonic; massage of the muscles is valueless, since it causes fatigue. Passive motion is contra-indicated; active motion is only indicated for re-education. Massage should always be light and soft, given for a short time only. M. G. Constensoux (*La Presse Méd.*, Dec. 6, 1902).

Frenkel's method consists essentially and in principle in the redevelopment, through certain exercises, of muscular co-ordination. Its usefulness is limited to the diminution of one symptom (ataxia) alone. Frenkel's special apparatus is not essential; any improvised procedure which observes and preserves the principle is sufficient and equally effective.

Method of treatment recommended for ataxia of the upper extremities. It is first necessary to determine which muscular groups are affected, and it is particularly important to know whether the shoulder-muscles are involved. Ataxia in the last-named region usually disappears readily and quickly under treatment, while that of the forearm and hand is corrected with more difficulty. A series of different apparatuses constructed for this purpose; the patient must, for

instance, insert a number of pegs in a plate provided with holes, catch swinging leaden balls, etc. The practice should be varied so that the patient may not grow fatigued and lose interest. They must also resume certain occupations (the fastening of their clothes, writing with pen and ink, piano-playing, etc.) in case they have, for greater ease, given these up. Even in pronounced cases of ataxia very good results may be expected; the moral effect of the treatment is also quite considerable. The improvement noticed by the patient and the physician exerts a powerful influence upon the disposition, sleep, and general condition. The sensibility of the skin and muscles also improves under this treatment. Frenkel (*Zeitsch. f. klin. Med.*, B. 28, '95).

Frenkel's method of curing ataxia by re-education of the movement used in nine cases. The exercises were performed once daily for about half an hour, and later for an hour; but the latter time should never be exceeded, nor should the patient be tired. In three of the cases the ataxia was so severe that there was total inability to walk or stand; in the remaining cases the ataxia was of the middle grade. In all the cases there was an improvement and in some a considerable improvement. Acute cases are not benefited until the case has reached a more stationary period. Hirschberg (*Arch. de Neurolog.*, vol. ii, Nos. 9-11, '96).

For exercising the upper extremities the following directions are given: Sit in front of a table, place the hand upon it, then elevate each finger as far as possible; raise the hand slightly, extend, and then reflex each finger and thumb as far as possible; do this with the right and then with the left hand. Touch with the end of the thumb each finger-tip separately and accurately; then touch the middle of each phalanx with the tip of the thumb. Sit at the table with a large sheet of paper and a pencil; make a dot at each corner of the paper and one in the centre, and draw lines from the corner dots to the centre dot, first with the right and then with the left hand. Put ten coins on the paper, pick them up and

place them in a single pile, first with the right and then with the left hand.

For the body and legs, sample exercises: Sit in a chair, rise slowly to erect position without help of cane or arms of chair; then sit down slowly; stand with cane, feet together; advance left foot and return it, then the same with right. Walk slowly ten steps forward and five back with help of canes. Stand without cane, but with feet a little apart and the hands on the hips; in this position stoop down by flexing the knees, and rise slowly. Stand without cane with the feet separated; raise the hands from the sides above the head; carry them downward and forward, and try to touch the toes. Walk along a fixed line on the floor by help of cane, placing each foot in turn on the line; then repeat without using the cane. Most of these exercises should be repeated several times, and the movements should be made with the eyes both open and closed.

Owing to disturbance of the sensory paths tabetics have lost the sense of fatigue, so there is some danger in overdoing the treatment. Two things are therefore insisted upon: first, every movement must be done with the greatest possible exactitude, and, second, the *séance* should not last more than eight or ten minutes, and no more than two should be allowed a day.

The treatment is absolutely contra-indicated in cases of acute or subacute ataxia. Frenkel (*Deutsche med. Woch.*, Dec. 17, '97).

All cases of locomotor ataxia are benefited by the exercise treatment, many to the degree of apparent recovery, unless there are special contra-indications to the treatment.

Contra indications are: loss of vision, mental impairment, bone- and joint-disease, spasticity, and muscular atrophy, the presence of strong irritation-symptoms, rapid progress of the disease, a state of great exhaustibility, and serious organic disease.

In cases of anæmia, poor nutrition, and lax joints these conditions should be remedied before the treatment is instituted.

The conditions most favorable for the

treatment are: a stationary or almost stationary state of the disease, good general health, intelligence, hopefulness, and perseverance.

Light cases are more amenable to a (practical) cure, but bad, even bedridden cases often give brilliant results.

The necessary duration of treatment varies from a month or more for the lightest to six months or a year for bad cases, but the exercises must be kept up in order to insure the continuance of the improvement.

Success of treatment depends upon thorough knowledge of the method.

Exercises should be chosen most suitable to the existing ataxia, and every effort should be made to do them with the greatest precision.

The sense of fatigue is often blunted in ataxics, while overfatigue injures them. The patient should, therefore, be guarded against too taxing or too prolonged exercises, or other unnecessary efforts.

To obtain most benefit from the treatment, the constant supervision of the physician, at least in its early periods, is absolutely necessary. Zenner (*Lancet-Clinic*, July 16, '98).

Not very obvious results noted from antisyphilitic remedies, though a course of them should always be tried in early cases. A short course of arsenic may also be advisable, and some good had appeared to result now and then from the use of testicular extracts. Galvanism along the spine and hydrotherapeutic treatment may also at times prove of service. For the ataxia, the best results are obtained by the method of graduated exercises as practiced by Frenkel. Trevelyan (*Quart. Med. Jour.*, July, '98).

Exercises are most applicable to moderately ataxic cases progressing only slowly. Considerable improvement obtained in one instance in the handwriting of an ataxic patient by exercises directed to the upper limbs. Thomson (*Practitioner*, Mar., '99).

In the application of exercises for training the inco-ordination of ataxic patients it is skill, and not strength, that it is sought to develop. It is important that the muscles should be healthy, and

massage and exercises should be directed if necessary; but, so far as the inco-ordination is concerned, it is necessary to teach the brain, and through it the lower reflex centres, to respond to the feeble and disjointed impulses that come from the skin and muscle. Elementary forms of movement must be practiced, and not the more complex ones. Combine amusement in some form in the movements to avoid fatigue and monotony. Personal instruction is necessary for understanding and obedience. Two cases of tabes cited in which many authors would consider such treatment contra-indicated. One with severe pains and inco-ordination was taught to walk with crutches or cane and showed marked improvement. Another acute case who was unable to walk without being held up was able to walk miles in three months unassisted, and afterward went back to work. J. J. Putnam (Boston Med. and Surg. Jour., Sept. 6, 1900).

At times the pains are so severe as to require immediate relief. Hot sitz-baths, the cold pack, ice-coils to the leg or an ice-bag or the cautery to the spine, may be tried with or without any one of several anodynes, the most reliable of which are antipyrine, antifebrin, phenacetin, or codeine. Morphine should be employed as a last resort and should be administered hypodermically.

Exalgin used in the treatment of the lightning pains of locomotor ataxia; doses of from 4 to 12 grains ordinarily employed. Desnos (*Revue Gén. de Clin. et de Thér.*, Feb. 15, '91).

To lessen pains acetanilid and phenacetin are most useful. Acetanilid is given in doses of 3 or 4 grains, in a little wine to hasten absorption, and repeated in ten minutes. Phenacetin may be given in doses of 6 to 8 grains two or three times a day. A combination of antipyrine, caffeine, and cocaine is also useful in some instances. Quinine sulphate (7 grains) is occasionally efficacious. When these fail, chloral and a hot bath may be recommended, and finally morphine. Exposure to cold and

wet often excites the pains. Hirschkron (*Centralblatt f. d. ges. Therapie*, Nov., '99).

In a case of tabes for seven years preceding the advent of symptoms which enabled a diagnosis to be made excruciating pains in the calves of the legs came on at intervals, and finally became so severe as to impair his health. Stretching of the sciatic nerve—i.e., flexing the thigh at right angles with the trunk, perhaps somewhat beyond this, then gradually extending the leg at the knee—soon caused them to yield. A few treatments were followed by some numbness in the feet, but this symptom passed off. A. H. Lindström (Boston Med. and Surg. Jour., Jan. 11, 1900).

For the relief of the various crises, symptomatic remedies are used. Full doses of oxalate of cerium usually relieve promptly the vomiting in gastric crises. Heart-tonics, such as caffeine, strychnine, etc., may be indicated in involvement of the vagus. Cystitis complicating locomotor ataxia may be treated symptomatically as an ordinary cystitis with relief. Trophic lesions are occasionally quite intractable. Strychnine in doses of $\frac{1}{30}$ to $\frac{1}{16}$ grain will at times retard the progress of an optic atrophy. Strychnine should, however, be given always with caution in this disease.

Case in which, after increasing doses of Fowler's solution, spinal-cord stretching, and static electricity had failed, strychnine nitrate was used. Strychnine nitrate, 1; glycerin, 240; water, 240; employed hypodermically. The initial dose was $\frac{1}{48}$ grain (10 drops of the above solution), which was increased until a dose of $\frac{1}{8}$ grain was reached; next, beginning with the initial doses, it was increased until $\frac{1}{4}$ grain was attained. Again, starting with the initial dose it was doubled, and trebled, until $\frac{3}{8}$ grain was taken at a dose. Under this treatment the pains did not return, the man could walk with the aid of a cane, and his general symptoms improved. Emil Altman (*Post-graduate*, No. 7, '98).

Large doses of strychnine hypodermically recommended; as much as $\frac{3}{4}$ grain at a dose given without any toxic effect whatever and with great benefit to the patient. It acts by improving the nutrition of the diseased portions of the cord. G. M. Hammond (Med. Record, Oct. 28, '99).

Of the first importance in treatment is general nutrition of the individual. This is to be done by generous diet, moderate stimulation, country-life out-of-doors, moderate exercise just short of fatigue, general massage, and more particularly by warm baths long continued, but never attended by shocks or forcible douches, but accompanied by rubbing. The use of antisyphilitic remedies is only indicated after the above object has been attained.

Systematic exercise by the method of Fraenkel is highly commended, but caution should be exercised against overdoing it. As to medication, codliver-oil, the glycerophosphates, arsenic, and all forms of tonics are best. Allen Starr (Phila. Med. Jour., No. 22, '99).

Treatment of locomotor ataxia based upon the experience of thirty years. The most good has been done where little or no medicine has been given. A line of treatment as good as any includes absolute rest, the suspension treatment, systematic and persistent cauterizing of the back, and improvement in the general condition or remedies which belong to the armamentarium of the mediæval leech, rather than to that of the progressive physician of to-day. A. McL. Hamilton (Montreal Med. Jour., Oct., 1900).

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LUMBAGO. See RHEUMATISM.

LUPULUS.—*Lupulus* (*humulus*, U. S. P.), or hops, is the strobiles or fruit-cones of *Humulus lupulus* (order *Urticaceæ*). The glandular powder adhering to the axis and bracts is called *lupulinum* and is the most important part of the plant. Hops contain a liquid, volatile

alkaloid (*lupuline* [?]), a bitter principle (*lupulinic acid*), 1 per cent. of volatile oil, 9 to 18 per cent. of resin, 3 to 4 per cent. of tannin, a fermentable sugar, diastase, and a small amount of asparagin.

Preparations and Doses.—*Humulus* (hops), not used internally.

Tinctura humuli (20 per cent.), 1 to 4 drachms.

Infusum humuli (non-official, 4 drachms to 1 pint), 1 to 4 ounces.

Lupulinum, 5 to 15 grains.

Extractum lupulinum fluidum, 10 to 30 minims.

Oleoresina lupulini, 2 to 7 minims.

Therapeutics.—**STOMACHIC TONIC.**—

Hops is useful as a stomachic tonic, and may be given for the purpose in an infusion (hop-tea), using a half-ounce to the pint of boiling water, of which almost unlimited quantities may be given. It is useful in simple flatulent colic; atonic dyspepsias, and mild diarrhœa. The infusion given in doses of $\frac{1}{2}$ to 1 wineglassful, before meals, increases the appetite and aids digestion. The infusion diluted with twice its bulk of water is useful as a summer drink and to quench the thirst in mild febrile affections.

SEDATIVE.—The tincture of hops and the oleoresin of lupulin are of great value in mild cases of delirium tremens, as they act both as a stomachic tonic and as a cerebral sedative. Bartholow suggests as a substitute for alcoholic stimulants:—

R Fluid extract of lupulin,
Tincture of capsicum, of each, 1 ounce.

Of this mixture 1 or 2 teaspoonfuls are given as necessary. The condition known as "horrors," or the wakefulness and excitement of the prodromal stage

of delirium tremens, may often be removed by the free use of this combination. Infusion of hops is also useful during recovery from a debauch or during treatment for alcoholism or the opium habit.

GENITO-URINARY IRRITATION. — In all kinds of irritation of the genito-urinary tract it is useful. Irritable bladder, priapism, chordee, seminal emissions, incontinence of urine, and sexual erethism in its varied phases yield to lupulin, given in doses of 5 to 10 grains in syrup or jelly (larger doses of lupulin may cause colic and constipation).

EXTERNAL USES. — Hops are useful externally as a sedative and soporific. For the relief of pain, the hop-bag—dipped into hot water, applied locally, and covered with rubber-cloth or oiled muslin—is a useful and efficient remedy.

The hop-poultice may be made by mixing hops in with the flaxseed-poultice when ready to spread upon the cloth. Hops may be inclosed in a flannel bag and then dipped into hot whisky and applied locally for pain, as in toothache or earache; the hops seem to add a soothing effect to the warmth and moisture.

Lefferts advises the use of inhalations of the vapor of hops in diseases of the throat and chest. He directs that 20 grains of dried carbonate of soda be dissolved in a pint of warm water (140° F.), 1 drachm of extract (inspissated fluid extract) of hops be added, and the vapor inhaled.

The hop-pillow has been used in insomnia especially when associated with neurasthenia.

LYMPHADENITIS. See ADENITIS.

M

MACE.—Mace (Macis, U. S. P.) is the arillode of the seed of *Myristica fragrans* (nutmeg), which is indigenous to the East Indies. Its active principle is a volatile oil, which closely resembles oil of nutmeg. Mace and its volatile oil are used principally for flavoring purposes, but occasionally as carminatives. Mace is given in doses from $\frac{1}{2}$ to 1 grain. The oil (non-official) may be given in doses of 1 to 3 drops on sugar.

Physiological Action. — The volatile oil, as shown by the experiments of H. C. Wood and Cadéac and Meunier, causes, when injected into the veins of lower animals, marked intoxication, characterized by tremors, loss of co-ordination, and gradually-increasing frequency of respiratory motions. In excessive doses there is narcosis; loss of reflexes and

death from paralysis of the respiratory centres follows.

Therapeutics.—Mace is an aromatic stomachic and tonic, and in large doses a powerful narcotic. The oil is sometimes employed externally, as a rubefacient in paralysis and rheumatism. Poisonous doses cause a sensation of great thirst, a feeling of tightness in the chest, and induce vomiting. Coffee and stimulants are indicated when poisonous doses have been taken.

MAGNESIA.—Magnesium is a metal, light and having the appearance of silver, which, when rolled in thin plates or ribbons, can be ignited, and will burn with a brilliant, white flame, giving off a dense white smoke, which is the oxide, or magnesia. The metal is not used in

medicine. The oxide, magnesia, and some of its salts, carbonate, citrate, and sulphate are official.

Magnesia (light or calcined magnesia) occurs as a very light, white powder, having a slightly alkaline taste. It is soluble in dilute acids and in carbonic-acid water. It unites with water forming a hydrate. Dose, 5 to 60 grains.

Magnesia ponderosa (heavy magnesia) occurs as a dense, white, very fine powder. It does not form a hydrate as readily as the light oxide. Dose, 5 to 60 grains.

Magnesium carbonas, or light carbonate of magnesium, is prepared by precipitation, and occurs as perfectly white, light cubes, of a slightly-earthy taste and very friable, and is soluble in 3000 parts of water, and more freely in carbonic-acid water. Dose, 1 to 3 drachms.

Magnesium citras effervescens, or granulated effervescing citrate of magnesium, is a mixture of magnesium citrate, a sodium bicarbonate, citric acid, and sugar. It occurs as a deliquescent, coarsely-granular, white powder, without odor, having a mildly-acidulated, pleasant taste, and being soluble in 2 parts of water. Dose, $\frac{1}{4}$ to 1 ounce.

Liquor magnesium citratis is made from magnesium carbonate, citric acid, syrup of citric acid, and water; before dispensing, potassium bicarbonate is added, the bottle securely corked, and then well shaken. Dose, $\frac{1}{4}$ to 1 ounce.

Magnesium sulphas (Epsom or bitter salt or salts) occurs in small, colorless prisms or needles, without odor, but having a bitter, saline taste; it is soluble in $1\frac{1}{2}$ parts of water. Dose, $\frac{1}{2}$ to $1\frac{1}{2}$ ounces.

Magnesia and magnesium carbonate are alkaline; magnesium citrate and sulphate are neutral salts.

Ferri oxidum hydrastum cum magnesia. See IRON.

Pulvis rhei compositus. See RHUBARB.

Infusum sennæ compositum. See SENNA.

Physiological Action. — Administered alone, magnesium acts very slowly as a purgative, but, contrary to the effects obtained from sulphate of sodium, the purgative effect seems to increase when the same dose is repeated several days in succession. Again, while the former agent gives rise to no notable phenomena in the intestinal tract, magnesium, according to Trousseau and Pidoux, may induce an active inflammatory process, thus giving rise to the bloody atonic evacuations and the tenesmus occasionally noticed. Arnaud Moreau observed that when a 15- to 20-per-cent. solution of magnesium was inclosed in an intestinal loop, between two ligatures, very active and localized secretion followed, the result of osmosis. The purgative action is also sustained, however, by the magnesium absorbed in the blood, though the salt thus absorbed is mainly eliminated by the kidneys. It can be found in the urine twenty-four or thirty-six hours after the purgative effects are produced.

To increase the rapidity of its action, citric acid is usually added to magnesium. A bicarbonate is thereby obtained which is actively cathartic.

Saline purgatives have the power of exciting more or less the glands of the intestines and of causing them to pour forth their secretions abundantly. In moderate doses magnesium sulphate accomplishes this without appreciably stimulating the peristaltic action. This being the case, a part of the fluid poured out may be reabsorbed and carry with it into the blood a quantity of the salt, and also cause the contents of the bowel to lose their fluid or semisolid consistency. This seems to explain its action when given hypodermically and also to explain constipation after the drug has been

given per rectum. In cases treated by the drug 2 or 3 grains of neutral magnesium sulphate injected into the deep muscular layers of the nates in men, or into the calf of the leg in women, were successful in 70 per cent. of the cases; 20 per cent. required more than one injection, and in 10 per cent. the bowels failed to act. In nearly all cases the bowels moved within ten hours after injection. James Wood (*Ther. Gaz.*, Jan. 15, '95).

The preparations of magnesium are not free from toxic properties when taken in large doses.

Case of a woman, aged 30 years, in her usual health, who on retiring at night, took an ounce of Epsom salts. On the following morning she was found, in her room, dead. A careful post-mortem and chemical analysis yielded no evidence of any other cause of death. A. P. Luff (*Brit. Med. Jour.*, Sept. 5, '91).

Case of a woman, about 35 years old, who took at a single dose 4 ounces of Epsom salts, dissolved in hot water. An hour later she had burning pains in the stomach and bowels; difficult respiration, attended by a choking feeling; and a peculiar weakness in the arms and legs. There was no vomiting or purging. Presently extreme collapse occurred; the pupils were dilated; there was slight twitching of the facial muscles; paralysis of the limbs was observed. The patient quickly became comatose, and death followed in an hour and fifteen minutes after the dose was swallowed. There was no autopsy. Lang (*Lancet*, Nov. 7, '91).

Case in which patient took 1 ounce of Epsom salts. Only three slight motions resulted, and towards evening he began to feel very ill, and remained so through the night. The following day he was too ill to do anything. His illness continued, and he vomited frequently during the day. At 6 P.M. he was found lying on the bed in an attitude of flexion, perfectly indifferent to his surroundings, but answering questions intelligently when smartly roused. The face and hands were deeply cyanosed, the lips, eyelids, *alæ nasi*, and auricles being of a dark-purple color, while the conjunctivæ were intensely congested and the pupils dilated and unequal. The covered parts of the

body presented a roseolous rash, and there was a zone of herpes zoster in the left submammary region extending around to the back. At this time the boy had several attacks of tetanic spasms, affecting the right side of the face and passing down the right arm, together with pronation of the hand. The tongue and teeth were covered with sordes, the stomach was enormously dilated, and urine was dribbling away. The right radial pulse was absent and the left hardly perceptible; the heart-beats were feeble and could not be counted. The extremities were cold; the axillary temperature was 105 degrees.

He was given a dose of hot brandy and water, well-covered with blankets and packed with hot-water bottles. This was followed by a draught containing carbonate of ammonia, spirit of ether, and tincture of *strophanthus*. During the night he had frequent vomitings of a greenish fluid. The next morning the cyanosis was less marked, the radial pulses were perceptible, and he was better and more conscious of his surroundings.

As his bladder was greatly distended, he was catheterized and about 40 ounces of urine drawn off. By the end of the week he was practically well. J. H. Neale (*Lancet*, Aug. 15, '96).

Therapeutics.—**ANTACID.**—Magnesia, *magnesia ponderosa*, and magnesium carbonate are used as antacids. Of these, *magnesia ponderosa* would seem to be, perhaps, the best. Magnesia has the disadvantage of being bulky in sufficient dose, and magnesium carbonate is apt to give rise to flatulence on account of the carbonic-acid gas given off when it is subjected to the disintegrating action of the acid of the gastric juice. The latter objection, however, does not always hold, since the stimulating action of the carbonic-acid gas upon the mucous membrane of the stomach is often beneficial, acting as a sedative and anodyne in the treatment of indigestion, sick headache, and pyrosis. In diarrhoea from indigestion, with acid stools, magnesia combined

with rhubarb yields very satisfactory results.

As a purgative, its most common administration is in the morning, and in a dose of from $\frac{1}{2}$ to 1 ounce. This may be greatly improved upon by giving from $\frac{1}{2}$ to 1 drachm administered in a pint of water. The water aids in establishing increased peristaltic action. The same dose given at bed-time is a most excellent diuretic, stimulates the skin and, therefore, the elimination of tissue-waste.

In migraine it should be given in doses of from $\frac{1}{2}$ to 1 drachm at bed-time, dissolved in a goblet of water. Warm water is more potent than cold water in this connection.

In hæmorrhoids and congestive disorders of the rectum and other pelvic organs it is often a specific. J. C. Culbertson (Jour. Amer. Med. Assoc., Nov. 18, '99).

Magnesia is free from taste, is non-irritating and antacid, and is, therefore, a very desirable remedy to administer to children. The carbonate combined with carminatives is especially useful in the flatulent colic and diarrhoea of young infants. Demers's formula is:—

R Carbonate of magnesia, $\frac{1}{2}$ drachm.
Tincture of asafoetida, 40 drops
Laudanum, 20 drops.
Sugar, 1 drachm.
Distilled water, 1 ounce.—M.

The dose is $\frac{1}{3}$ to 1 teaspoonful, according to age.

Dalby's formula is similar:—

R Carbonate of magnesia, 40 grains.
Oil of peppermint, 1 drop.
Oil of nutmeg, 2 drops.
Oil of anise, 3 drops.
Tincture of castor, 30 drops.
Tincture of asafoetida, 15 drops.
Tincture of the oil of pennyroyal, 15 drops.
Compound tincture of cardamom., 30 drops.
Peppermint-water, 2 ounces.—M.
The dose is a teaspoonful as required.

Gout and lithiasis are benefited by the use of antacid magnesia preparations, but the potash- or lithia- salts are more efficient.

ANTIDOTE TO POISONS.—The antacid properties of magnesia make it valuable as a antidote in cases of poisoning by the strong mineral or vegetable acids. It neutralizes the acids and acts as a mechanical protective to the tissues against the corrosive action of the acid-poisons. Its value as an antidote in poisoning by metallic salts depends upon the fact that it precipitates many metals from their acid of combination, and thus renders the metal less soluble and, therefore, less poisonous. In poisoning by arsenic, freshly-prepared hydrate of magnesia is an antidote of no mean value, but is not so effective as the official hydrate oxide of iron with magnesia, of which doses of 1 to 4 drachms are given.

PURGATIVE.—Magnesia and carbonate of magnesia are often used as purgatives in children, as before mentioned. The neutral salts, the citrate and sulphate, are more generally used for this purpose. Magnesia and the carbonate are hardly suitable for continuous administration, as, being insoluble, they may accumulate in the intestines and form concretions consisting of the hydrate of magnesia. The citrate and sulphate of magnesia cause little, if any, irritation, and are on that account valuable as laxatives in enteritis and peritonitis. In febrile affections, given in small doses, they exert a refrigerant and slight diuretic action. Combined with iron, they are useful in constipation associated with atonic conditions. In anæmia and chlorosis, which Clarke attributes to fæcal intoxication, the "mistura ferro-salina" is a useful tonic laxative.

℞ Sulphate of magnesia, 1 ounce.
 Cream of tartar, 1 drachm.
 Dried sulphate of iron, 10 grains.
 Water, 2 pints.—M.

Of this a wineglassful should be taken a half-hour before breakfast each morning.

The constipation of lead poisoning is relieved best by magnesium sulphate as follows:—

℞ Magnesium sulphate, 2 drachms.
 Morphine sulphate, 1 grain.
 Peppermint-water, 3 ounces.

Mix and give a tablespoonful every two hours in lead colic.

The purgative mineral waters (Friedrichshall, Pullna, Seidlitz, and Hunyadi waters) owe their purgative action principally to the presence of magnesium sulphate.

SEROUS EFFUSIONS. — Magnesium sulphate given in doses of 1 or 2 ounces daily, in as little water as will dissolve the salt, will yield good results in serous effusions (pleural, peritoneal, etc.), especially if the amount of fluids ingested be restricted. It may be given by enema if preferred, as proposed by Watkins:—

℞ Magnesium sulphate, 2 ounces.
 Glycerin, 1 ounce.
 Water, 4 ounces.

ŒDEMA AND ANASARCA. — Œdema and anasarca are relieved in a similar manner by magnesium sulphate. It relieves the congestion of the kidneys in general anasarca. It is also of value in œdema of the lungs and brain, in Bright's disease, and ascites. In uræmia associated with constipation, magnesium sulphate is a valuable remedy.

DIARRHŒA AND DYSENTERY. — Diarrhœa from fæcal impaction is best relieved by small doses of magnesium sulphate every hour. It is also useful in dysentery combined with aromatic sul-

phuric acid and laudanum. In acute dysentery it will often remove the fever, the blood and mucus from the stools, and the tenesmus. Leahy advises the use of the following: Saturate 7 fluid-ounces of water with a sufficient quantity of magnesium sulphate, and add 1 ounce of diluted sulphuric acid. Of this give a tablespoonful every hour or two in a wineglassful of water until it operates. Morphine may be added, or starch enemata with laudanum may be used.

RECTAL DISORDERS. — Magnesium sulphate is an agent of great value in rectal disorders, as it liquefies the fæcal passages and renders them less irritating. In cancer or stricture of the rectum and fissure of the anus this is very desirable. This and other salines will act painlessly upon the bowels of a patient fully under the influence of opium, which renders them especially useful in atony of the rectum.

The unpleasant taste of magnesium sulphate may be disguised by a small amount of the fluid extract of licorice or by boiling it with or giving it in coffee. For general use 4 ounces of magnesium sulphate may be dissolved in 4 ounces of lemon or other syrup, and enough water added to make one pint. Of this the dose is a wineglassful or two.

EXTERNAL USES. — Magnesium and the carbonate are used as a toilet powder, to dry the skin, to prevent chapping and excoriation in intertrigo, and to relieve the irritation due to sunburn and that left after shaving. This is applied also as a cosmetic to relieve the shining appearance and gloss of the facial integument, the cubes of magnesium carbonate being generally preferred for this purpose.

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MALARIAL FEVERS.

Definition.—Under the name malaria is included that group of diseases due to infection with the animal parasite described by Laveran and now known as the *hæmatozoön malarie*, or, less appropriately, *plasmodium malarie*.

The term malaria was originally applied to these diseases to designate the conditions then most evident in their production, having its derivation from the Italian *mal'aria*, the English equivalent of which is "bad air." While this is in no wise descriptive of the disease, either clinically or pathologically, the name has obtained such wide usage that its continued employment is fully justified.

The protozoön discovered by Laveran is to be regarded as always present in malaria, and in accordance with the variety, or species, of the parasite present its effects are manifested as quartan and tertian fever, which are the regularly intermittent forms of the disease, and as æstivo-autumnal fever, which includes the irregularly intermittent and remittent forms, as well as the pernicious varieties and chronic malarial cachexia.

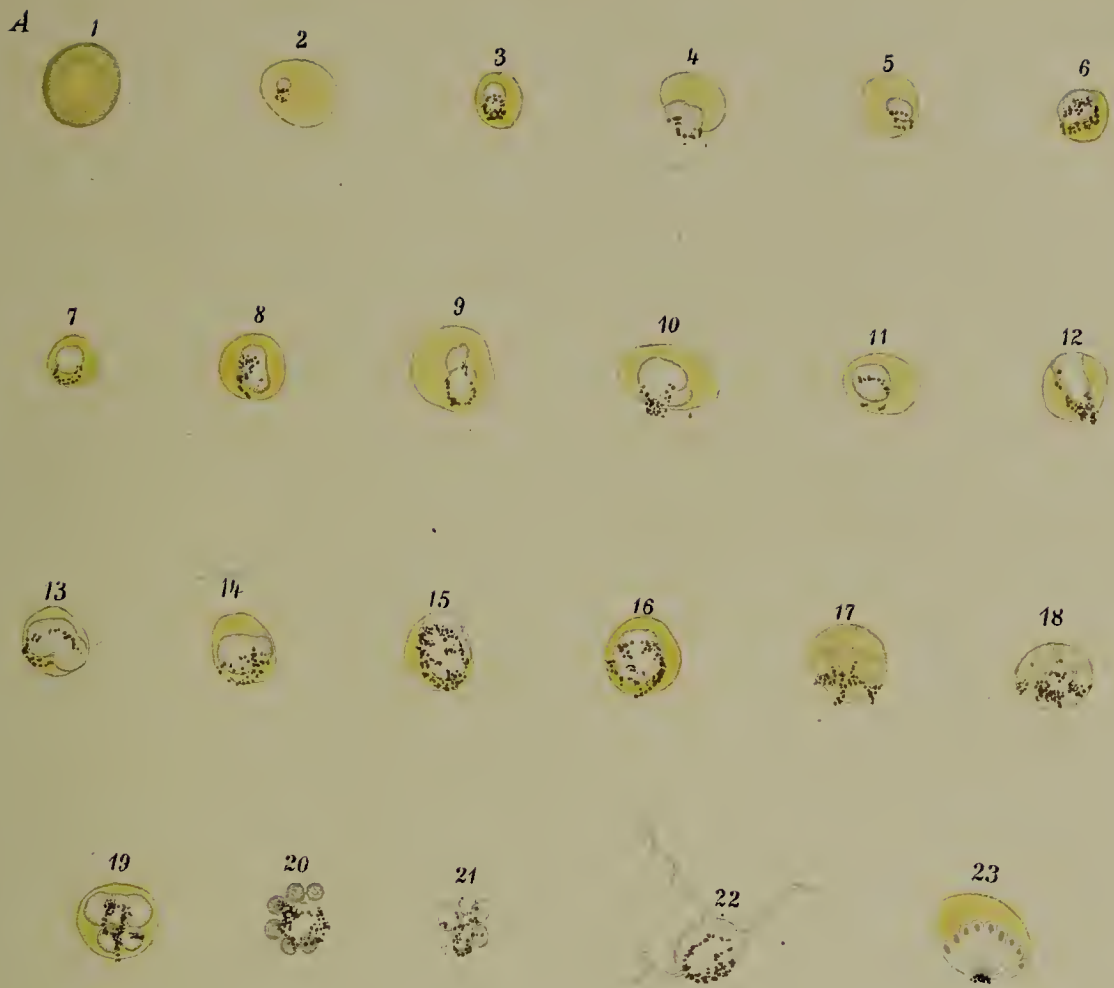
Synonyms.—Malarial fever is known by many synonyms, which are frequently derived from the localities in which it prevails; as, Roman fever, Chagres fever, Panama fever, African fever, jungle fever, lake fever, coast fever; also, paludism, paludal fever, autumnal fever, marsh fever, swamp fever, marsh miasm or miasmatic fever, fever and ague, and chills and fever. In accordance with the intensity of particular symptoms the disease may be known as intermittent fever, remittent fever, congestive fever, black-water fever, hæmorrhagic malarial fever, and bilious remittent fever.

The Malarial Parasite and Mechanism of Infection.

The malarial parasite is a unicellular organism belonging to the class of protozoa, and first discovered and described by the French military surgeon Laveran in 1880. Since the publication of Laveran's discovery his observations have been confirmed and enlarged upon by many observers in all parts of the world, and, while there is still but little known of the life of the organism outside the human body, its causative relation to malarial fever has been conclusively demonstrated. Laveran's work was first confirmed by Richard, in Algiers, in 1882, and later by Marchiafava and Celli, the results of whose observations were derived from the study of dried malarial blood subjected to staining. In 1885-86 our knowledge of the subject was greatly advanced by Golgi, who proved the relation existing between the different stages of the malarial paroxysm and the cycle of development of the parasite. The same observer first recognized two special varieties of the parasite as belonging each to quartan and tertian fever, while still later, in 1889, Marchiafava and Celli recognized particular forms associated with æstivo-autumnal fever. In America the investigations of Councilman, Sternberg, Osler, Dock, and Thayer and Hewetson have added much to our knowledge of the subject.

It will thus be seen that at least three varieties of malarial parasites are to be considered, each of which passes through a cycle of development which in its general characteristics is common to all. In accordance with the variety of parasite the cycle of development varies in duration from twenty-four to seventy-two hours. Development begins in the form of small, hyaline bodies within the red blood-cells, possessing the power of amœ-

PLATE I.



C



D



The Malarial Parasite (Mannaberg.)

"Die Malariaerkrankungen" A. Hölder, Publisher, Vienna.

boid movement, and without color. Increase in the size of these bodies takes place and coincidentally there is to be observed within them, near the periphery of the parasite, a collection of pigment-granules. These granules increase in amount with the further development of the parasite, and are frequently observed to be in active motion.

With the attainment of maturity the parasite gradually becomes quiescent, and completely or only partly fills the red blood-cell, as the description may apply to one or the other variety of parasite. Changes in the corpuscular host of the parasite, affecting chiefly its shape and color, occur coincidentally with the various stages of parasitic development.

The parasite having reached its full development, the pigment-granules within it begin to clump, usually near the centre, and the stage of segmentation commences. When completed, the process divides the parasite into a number of oval bodies or spores, while the corpuscle which has acted as host bursts and the subdivisions of the parasite, or spores, are set free, the pigment-granules remaining behind to float free in the blood-serum or to be taken care of by the process of phagocytosis. The spores thus set free very soon enter fresh corpuscles and there begin the cycle of development anew.

A very quick process of staining malarial parasites in dry specimens and very serviceable when one is called out to see a suspicious case and has not a microscope at hand with which to examine the fresh blood, is as follows: The dried-blood specimens, made in the usual way described by Ehrlich, are then fixed in a $\frac{1}{4}$ -per-cent. solution of formalin in 95-per-cent. alcohol. It is important that the formalin solution should be made up fresh every time it is used. Satisfactory results have been obtained by adding 4 or 5 drops of a 10-per-cent. aqueous solution of formalin to $2\frac{1}{2}$ drachms of 95-

per-cent. alcohol just before using. The specimens are fixed in this solution for only one minute, washed in water, blotted, and then stained in the special mixture, which consists of a saturated solution of thionin in 50-per-cent. alcohol, of which $2\frac{1}{2}$ drachms are added to 3 ounces of a 2-per-cent. carbolic-acid solution. This solution can be kept in stock and used as required. Only 10 to 15 seconds are required for staining. The malarial parasites come out very distinctly as reddish-violet bodies with this stain, and it is especially serviceable in staining the ring-shaped bodies of the æstivo-autumnal infection. With the thionin stain the parasites retain the color much better than they do when stained with methylene-blue.

The method of fixing and staining malarial parasites is then as follows: Make the ordinary smear preparation, fix in the formalin solution for one minute, wash in water, thoroughly dry, stain with the thionin solution for from ten to fifteen seconds; ten will probably give the most satisfactory results. Wash off the excess of stain, blot, mount in balsam, and the specimen is ready to be examined. The whole preparation does not last for more than two minutes from the time of beginning until it is ready for examination. Fletcher (Johns Hopkins Hosp. Bull., Apr., '99).

New method for the microscopical diagnosis of malarial fever, which consists in preparing thick blood-films, drying these (being careful to avoid fixation), then staining with an aqueous eosin solution followed by carefully washing the stain from the preparation, and then counterstaining with an aqueous methylene-blue solution for a few seconds, rinsing with water, drying the preparation, and mounting it. By this method the hæmoglobin is removed so that the parasites are easily recognized in the thick preparation. Dehæmoglobinized thick film preparations are twenty-five times better for diagnostic purposes than the thin film preparations, as the parasites are much more numerous and therefore easily found. The smallest intracorpuseular hyaline parasites in such films are easily recog-

nized when properly stained. R. Ross (Lancet, Jan. 10, 1903).

In accordance with the observations of Golgi and of Marchiafava and Celli, confirmed by many others, three varieties of parasites may be differentiated: (1) the parasite of quartan fever, (2) the parasite of tertian fever, and (3) the parasite of æstivo-autumnal fever.

COLORED PLATE I.—*Parasites of the First Group*.—Fig. A. 1-22. Phases of development of the quartan parasite. 23. Rare form of sporulation. Fig. B. Plan of the sporulation of the quartan parasite according to Golgi. Fig. C. Melaniferous leucocytes. Fig. D. Vacuoles of red corpuscles undergoing changes in shape.

1. The *quartan parasite* attains its full development in seventy-two hours and shows more regularity in its evolution than any other variety. Unlike the tertian and æstivo-autumnal varieties, it completes its development, not in the viscera and bone-marrow, but entirely in the circulating blood.

The young parasite is small, about one-fifth to one-fourth the size of the red blood-cell, and exhibits amœboid movements that are sluggish when compared with the movements of the tertian parasite. As the parasite grows, occupying eventually a little more than one-half to two-thirds of the corpuscle, pigment-granules appear within it. This pigment is coarse and dark, as compared with the pigment within the tertian parasite, and does not present the active motion to be observed in the pigment-granules of the latter variety. The corpuscle surrounding the parasite often becomes deeper in color and frequently assumes a coppery hue, while at the same time it may become a little smaller and somewhat shriveled. In the full development of the parasite the corpuscle is frequently observed as a thin layer surrounding the

parasite, which now presents the evidences of segmentation and the massing of pigment-granules. This, however, does not always take place in the centre of the parasite, but frequently toward the periphery, and not uncommonly shows a striated arrangement. This distribution of the pigment in striæ extending from the periphery to the centre divides the organism into segments, from six to twelve in number, in which can be observed the spores, and thus produces the rosette forms described by Golgi. The completion of segmentation results in setting free the spores which, as young hyaline bodies, invade other corpuscles and begin a new cycle of existence.

At times, infection by more than one group of quartan parasites occurs, resulting, if the infection be with two groups, in double quartan, if with three groups in triple quartan fever.

Although, as stated, the quartan parasite is more regular in its development than the other varieties, deviations in certain instances from the description just given may be noted. The mature parasite, instead of sporulating, may, in the quartan variety as well as any variety, develop into the flagellate form; while certain other parasites, failing of sporulation, after escaping from the corpuscles become much swelled and present irregularities of outline, eventually breaking up into a number of irregular forms, or becoming vacuolated in their entirety.

COLORED PLATE II.—*Parasites of the First Group*.—Fig. A. 1-22. Phases of development of the ordinary tertian parasite (17 and 18, according to Thayer and Hewetson). 23-29. Hydropic, degenerated, disintegrated bodies. Fig. B. Plan of sporulation of the tertian parasite according to Golgi.

2. The *tertian parasite* requires forty-eight hours to complete its cycle of development. Although this parasite is to be found in the circulating blood during

PLATE II.



The Malarial Parasite (Mannaberg.)

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certain stages of its development, sporulation takes place chiefly in the spleen and bone-marrow, and in this particular differs from the quartan organism. The young tertian parasite appears in the red blood-corpuscles as a small, pale body, 1 to 2 microns in diameter, possessing active amœboid motion. Not only are the movements more active than with the quartan parasite, but from the periphery of the tertian parasite long, branching prolongations, or pseudopodia, are sent out and which very soon are again withdrawn, to be followed by another change in the shape of the organism. This stage of development may last for twenty-four hours, and then the parasite begins to collect pigment-granules and rods, which are finer and of lighter color than in the quartan parasite, and tend to collect particularly around the periphery of the organism. The movement of the pigment-granules is very active. As the parasite develops, the accumulation of pigment increases and the amœboid movements lessen. Nevertheless these movements do not cease altogether, for even during the period of the paroxysm marked by apyrexia pigmented parasites may be observed to undergo strange alterations in form by the sending out of pseudopodia, although by this time more than half of the red blood-corpuscle serving as host may have been occupied. (Mannaberg.) The red blood-corpuscles infected with the tertian parasite undergo decided changes, becoming distinctly swelled, and, when compared with the uninfected corpuscles, are observed to be much paler than normal. At times, however, the red blood-corpuscles may not increase in size, but may actually shrink and present a brassy or greenish tint.

After the lapse of about forty-eight hours sporulation occurs, having been

preceded by the complete quiescence of the parasite and the aggregation of the pigment-granules into a mass near its centre. Just prior to segmentation the parasite attains about the size of the normal red blood-corpuscle, while the swelled corpuscle containing it becomes pale in color.

Segmentation occurs by the splitting up of the parasite into 15 or 20 divisions, or segments, which are not arranged with the regularity characterizing the quartan parasite. The larger number of spores contrasted with the smaller number resulting from segmentation of the quartan parasite constitutes an important factor in the differentiation of the two varieties of parasites. The spores of the tertian parasite are round and smaller than those of the quartan parasite, and a refractive dotlet, the nucleolus, which is less defined than in the quartan spores, can usually be observed.

The spores having been set free, fresh blood-corpuscles are entered, and as young parasites the cycle of development is again gone through.

The act of sporulation in tertian, as in quartan, infection corresponds with the occurrence of the paroxysm, and several hours before this event individual spores may be detected in the blood; they are to be found, however, in greatest number at the time of the occurrence of the chill or during the beginning of the hot stage of the paroxysm.

In tertian infection not all the parasites pass through their cycle of development in a typical manner, and the occurrence of flagellate bodies and other degenerated forms, such as vacuolation, fragmentation, etc., is far more common than in the quartan variety.

Infection with two groups of tertian parasites may occur, passing through their cycle of development and attaining

maturity upon successive days. This is of more common occurrence than infection with a single group, and results in the production of a fever of quotidian type.

Anticipating and postponing fevers of the tertian variety are to be explained by the tendency to the lack of regularity in the time necessary for the completion of its cycle of evolution; thus, the time required may be shorter or longer than forty-eight hours.

3. The *æstivo-autumnal parasite*, or *Hæmatozoön falciparum* of Welch, presents peculiar difficulties in study for the reason that its cycle of development is completed mainly within the internal organs. Its development is accompanied with more irregularity than that which attends the other varieties of parasites, and, while clinically it may be possible in the milder instances of infection to recognize certain types, such as quotidian and tertian, the type is so confused as to render its analysis almost impossible. Recent investigations have not succeeded in satisfactorily proving that these clinical variations depend upon infection with special varieties of *æstivo-autumnal parasites* completing their cycles of development upon different days, and the majority of observers have been unable to accept the division of the *æstivo-autumnal parasite* into a quotidian and tertian variety as urged by Marchiafava and Bignami.

[In this connection Thayer and Hewetson ("Amer. System of Prac. Med.," "Malaria," Welch and Thayer, vol. i, p. 39) say: "We have been unable to trace a constant length of the cycle of development, and we have been unable further to separate two or more types of the (*æstivo-autumnal*) parasite depending either upon the length of the cycle of development or upon any other morphological or biological differences. We believe that the length of the cycle varies greatly

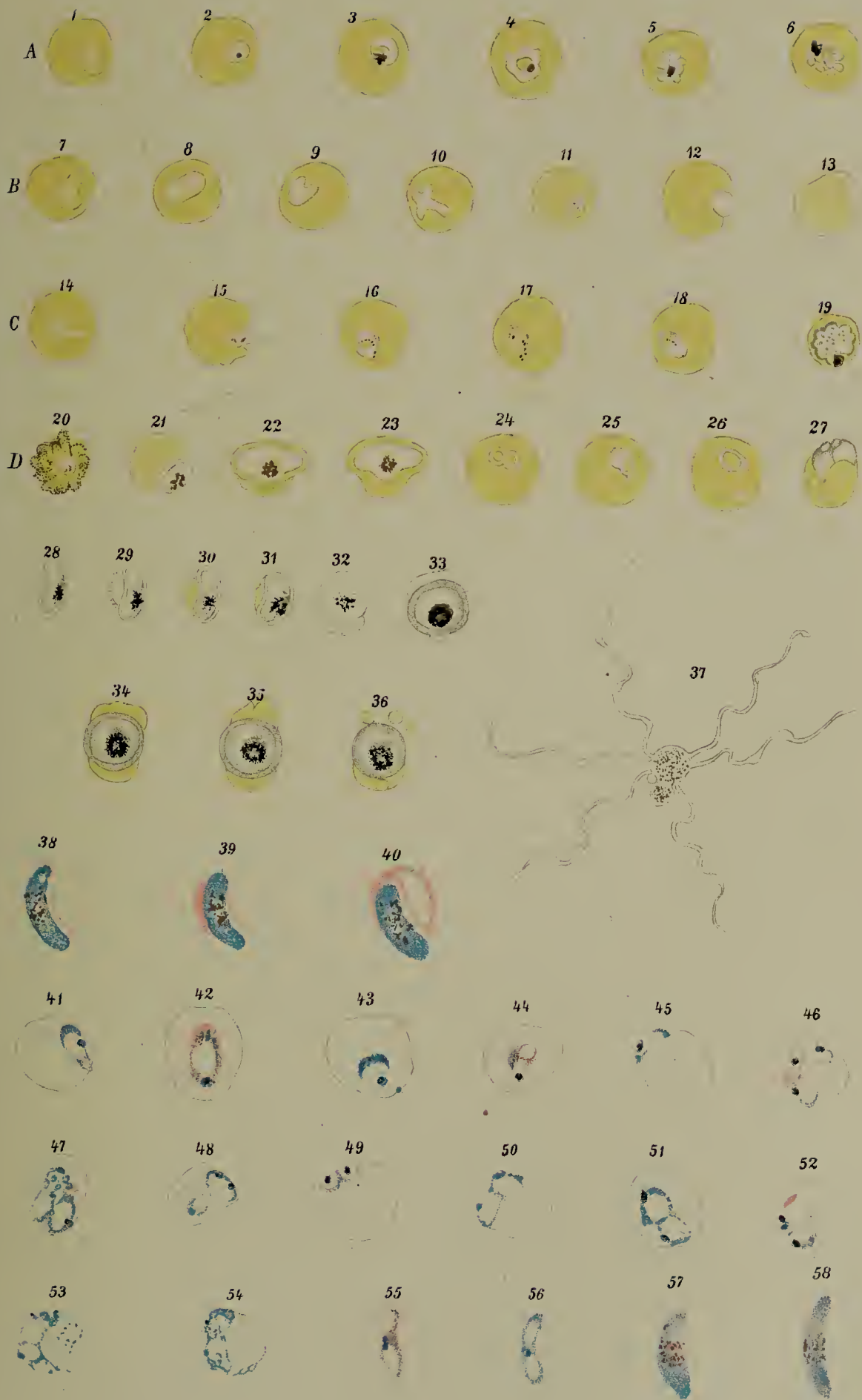
in different cases, lasting usually from twenty-four hours, or even a little less, to forty-eight hours or more. After the infection is five days or a week old certain of the organisms, instead of segmenting, pursue a further growth, developing into the hyaline, refractive, ovoid, and crescentic bodies."

The contrary view, in favor of the division, made by Marchiafava and Bignami, is held by Mannaberg (Mannaberg, 1899: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 68), who not only concurs in the division of the *æstivo-autumnal parasite* into quotidian and tertian, but further subdivides the former into the pigmented quotidian parasite and the unpigmented quotidian parasite. JAMES C. WILSON and THOMAS G. ASHTON.]

The *æstivo-autumnal parasite* possesses the distinctive characteristic of producing crescent-shaped bodies; hence Welch has proposed for it the name of *Hæmatozoön falciparum*. These bodies are not usually found in the blood until a case of *æstivo-autumnal fever* has lasted for a week or more. Their development is now regarded as intracorpuseular, and in the early stages of their evolution they are infrequently met with in the circulating blood. In the spleen and bone-marrow, however, particularly the latter, they are to be found in abundance. They are to be regarded as *transformed* from the intracorpuseular spherical organisms, and do not belong to the cycle of development as regularly performed by the parasite. Instead of being crescentic, these bodies may be oval or fusiform in outline, and, of whatever form, are always pigmented.

The young hyaline body of the *æstivo-autumnal parasite* is the smallest of the malarial parasites, and, while in its earliest stages it may not show much activity, in the course of its development it presents marked amœboid movements. It is to be observed in the red blood-corpuseular during or shortly after the par-

PLATE III.



The Malarial Parasite (Mannaberg.)

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oxysm, and is about one-sixth the diameter of its host. The young parasite is distinct, and stands out in contrast to the surrounding structure of the blood-corpuscle. This clear, hyaline ring is usually thicker at one portion of its circumference, and presents one or more central or eccentric shaded dots, through which may be seen the color of the red blood-corpuscle; these spots are supposed by some to be nuclei.

With the development of the parasite amoeboid movements become active and are frequently attended with the throwing out of pseudopodia. Pigment-granules, at first very fine and dark brown in color, soon begin to appear toward the periphery of the parasite. These granules later increase in size and number; but it is distinctive of the æstivo-autumnal parasite that they are fine and relatively few in number and possess but little motion. With the approach of the paroxysm the parasite becomes quiescent and the pigment-granules collect at or near its centre. The parasite next enters upon the stage of sporulation, which is characterized by much greater irregularity than the corresponding stage in the evolution of the other varieties of malarial parasites. The number of spores is variable and may range from six to twenty or more.

The corpuscle enveloping the parasite may not show any change in appearance. Very frequently, however, it becomes shrunken and deformed and assumes a brassy color, with retraction of the hæmoglobin away from the periphery and its distribution around the parasite. The fully-developed parasite in the presegmenting stage is smaller than the quartan and tertian parasites at a similar period of their evolution, and, as a rule, is not more than one-fourth or one-third the size of the red blood-corpuscle.

Fever of a quotidian or tertian type may result from æstivo-autumnal infection, and this association is to be ascribed to variations in the length of the cycle of development of the parasite rather than to infection with supposed special varieties. As previously observed, however, Marchiafava and Bignami, Mannaberg, and others subdivide the parasite into quotidian and malignant tertian varieties, the latter in contradistinction to the tertian parasite of the regular variety described by Golgi. Further, not all of the æstivo-autumnal parasites develop pigment-granules, and cases occur in which no pigmented bodies are to be observed at any stage. This fact has led to the further subdivision of the so-called quotidian æstivo-autumnal parasite into pigmented and unpigmented forms (Grassi and Feletti, Mannaberg). The following description is given by Mannaberg as distinctive of these varieties:—

COLORED PLATE III.—*Parasites of the Second Group.*—Fig. A. 1-6. Pigmented quotidian parasites. Fig. B. 7-13. Unpigmented quotidian parasites. Fig. C. 14-19. Malignant tertian parasites. Fig. D. 20. Corpuscle showing brassy discoloration. 21-37. Bodies of the crescentic series. 24-26. Coalescence of two amoeboid parasites (copulation). 27. Syzygy. 38-40. Stained crescentic forms (Romanowsky's method). 41-58. Stained parasites of the second group. 49-57. Showing the origin of the crescentic bodies: syzygies (staining with hæmatoxylin after picric-acid fixation).

The *pigmented quotidian* parasite completes its development in twenty-four hours; it begins its existence, as do the other forms, as a very small body without pigment. It is pale and forms but little contrast with its containing blood-corpuscle; so that it would readily be overlooked were it not for the active amoeboid movements it possesses. When at rest, however, it appears as a small distinct ring of pale color and with a red-

dish centre, the latter appearance being probably due to the thinning of the parasite at that point, permitting the color of the red blood-corpuscle to be seen through it. The young parasite contains very fine pigment-granules, which often are quite red and which are to be seen occupying its periphery. When the parasite has attained to the size of about one-third of the blood-corpuscle, the pigment collects in the middle or in that portion of the border where amœboid movements have ceased. Following the massing of the pigment in this manner into a dark, quiescent clump the parasite breaks up into a limited number of very small spores. Occasionally the organism attains a considerable size and at the time of its sporulation may occupy almost the entire blood-corpuscle. It frequently happens, however, that the corpuscle becomes shrunken and assumes a brassy hue. After the infection has continued for a number of days crescents are to be observed; these may be the ordinary crescentic-shaped bodies, the fusiform bodies with pointed extremities, or the spherical bodies of this group.

The Unpigmented Quotidian Parasite.—The occurrence of a malarial parasite that completes its cycle of existence, even to sporulation, without accumulating pigment has been described by Marchiafava and Celli, whose observations have been confirmed by others. Except for the absence of pigment, this parasite resembles the pigmented quotidian parasite so closely that the same description may answer for both. In the early stage of its existence it possesses the same amœboid movements and completes its cycle of development in about the same time, or, perhaps, somewhat sooner. As in all æstivo-autumnal varieties, sporulation is carried on almost entirely in the internal organs. From this form of

parasite, also, crescents develop which, of course, contain pigment: a characteristic common to all members of the crescentic group.

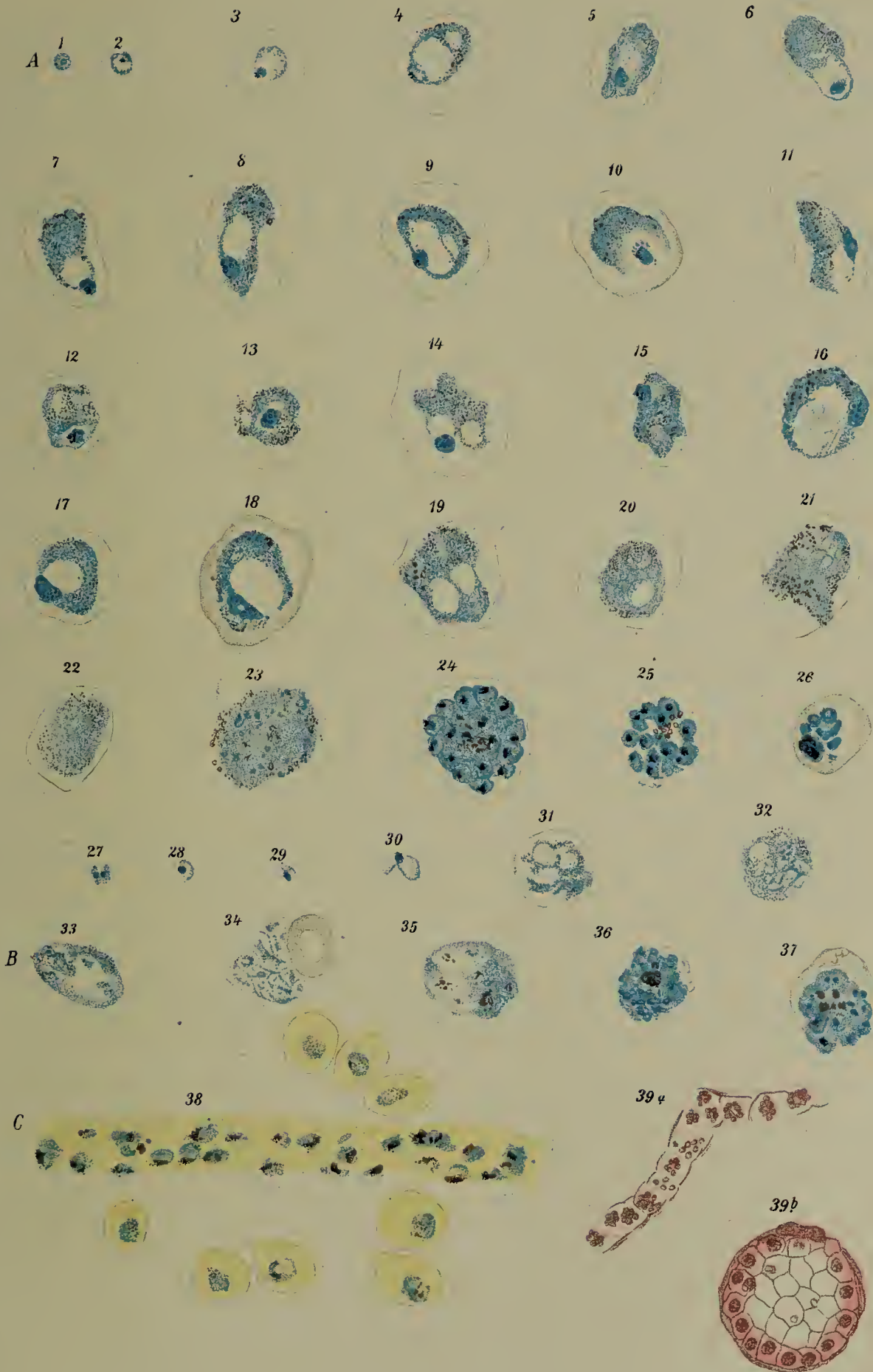
COLORED PLATE IV.—Fig. A. 1-32. Ordinary tertian parasite, showing staining of its structure according to the method of Manna-berg (picric acid, hæmatoxylin). Fig. B. Showing changes produced by the administration of quinine. Fig. C. 38. Cerebral capillary with pigmented parasites of the second group (from a preparation by Professor Celli). 39. Cerebral capillaries with unpigmented sporulating parasites of the second group (from a preparation by Professor Celli).

The Malignant Tertian Parasite.—

This variety of parasite was separated from the other forms by Marchiafava and Bignami. In its morphological characteristics it resembles very closely the pigmented quotidian parasite from which in many stages of its development it is with difficulty differentiated. Marchiafava and Bignami claim for it the following points of dissimilarity: 1. Its cycle of development continues forty-eight hours. 2. The pigment sometimes shows oscillatory movements, which do not occur in the quotidian parasite. 3. The parasite attains a considerable size and at the time of sporulation occupies one-half or two-thirds of the blood-corpuscle. 4. In the advanced stages of pigmentation active amœboid movements are still to be seen. 5. The unpigmented stage lasts over twenty-four hours.

From the ordinary tertian parasite the malignant tertian parasite differs in the following particulars: 1. In all stages the malignant tertian parasite is smaller. 2. It often assumes the distinct ring-shape which the ordinary tertian parasite lacks. 3. Pigment-granules are not so numerous and only exceptionally show motion. 4. The infected blood-corpuscles show a tendency to shrink, while in the ordinary tertian infection they swell up. 5. The spores are smaller and not

PLATE IV.



The Malarial Parasite (Mannaberg.)

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so numerous. 6. The pernicious tertian parasite develops crescents.

Degenerate forms of the æstivo-autumnal parasite, hydropic, fragmented, flagellate, or vacuolated, occur as in the other forms of malarial infection. These are derived from those parasites that fail to properly mature and undergo segmentation, particularly the extracorpuseular bodies which in this variety of infection are common.

Infection with two or more groups of æstivo-autumnal parasites, each in a different stage of development, is of common occurrence, and a combined infection with one of the other varieties, especially the tertian, is occasionally seen.

The development of *crescentic*, ovoid, or fusiform bodies and the significance of their association with æstivo-autumnal infections have already been referred to. These bodies are not likely to be observed in the blood until the fever has lasted for a week or more; they may persist, however, for several weeks after other forms of the parasite have disappeared. The intracorpuseular origin of crescents has been proved by Marchiafava and Celli and confirmed by many others, and, as stated, they result from the transformation of intracorpuseular spherical forms of æstivo-autumnal parasites, which at this point fail to continue their orderly cycle of development. Except rarely, only fully-developed crescents are observed in the circulating blood, the early stages of intracorpuseular development taking place in the spleen and, especially, the bone-marrow. They are always pigmented, and the pigment, which is very dark in color and usually in fine rods or granules, is without movement and is collected in one or two masses near the middle of the organism. In crescents that are not fully developed the pigment is less regularly disposed. From cres-

cents flagellate bodies may develop, but only from the round bodies of the group.

[According to the view entertained by Mannaberg, crescents are to be regarded as encysted syzygies produced by the conjugation of two parasites (æstivo-autumnal) and therefore capable of segmentation and reproduction. This, however, is not the generally-accepted hypothesis regarding the significance of these bodies. The majority of observers hold to the view that, in the human body at least, they exist as sterile forms, and, if they possess any reproductive faculty, require for its accomplishment some favorable extracorpuseular environment. Bignami and Bastianelli (Lancet, Dec. 17, '98), in their latest contribution to this subject, arrive at these conclusions: "We have, indeed, favored the idea that the semilunar bodies are sterile on the grounds that one never sees in them any form of multiplication and that they have no relation to relapses; and these assertions, even in the light of these new observations, we still hold by as in accordance with the truth. In other words, we contended that crescents are sterile bodies *in man* and *as far as man is concerned*. In fact, we put forward the additional hypothesis that these bodies represent those phases of the life of the malarial parasite which in other parasites are continued and completed outside of the host. Should such migration from the host fail to occur, then that phase of life which cannot be completed except in the outside world or in a new host will be carried out in an abortive way and will terminate in forms of degeneration.

"Certainly these new researches render probable the hypothesis that the cycle commenced in the blood of man is completed in some species of mosquito, but they nevertheless do not negate the truth of the fact alluded to in our first hypothesis in those cases where the passage from man to the new host fails to take place." JAMES C. WILSON and THOMAS G. ASHTON.]

Flagellation is an occurrence common to each of the three principal varieties of parasites. It is to be observed within

eight to twenty minutes after the blood has been withdrawn from the body and does not occur in the circulating blood. As already pointed out, in æstivo-autumnal infection flagellate bodies develop only from the spherical form of the crescentic group, while in tertian and quartan infections their origin is from the full-grown extracorporeal organisms. The length of the flagella varies from one-half the diameter of a red blood-corpusele to an extent three or four times longer. Their number may vary from one to six and their attachment may be to any portion of the circumference of the body. Free, detached flagella may also be observed. As may be surmised, the active movements of the flagella produce a marked disturbance of the blood-corpuses.

Under ordinary circumstances flagellated plasmodia do not appear in a specimen of blood until some time after it has been removed from the body, generally from fifteen to twenty minutes. The following method of obtaining these bodies is at once simple and effective: The finger or ear is carefully cleansed with alcohol, as are also the slides and cover-glasses. A small elastic band is now placed around the finger, or, if the lobe of the ear is used, it is compressed by an assistant. The puncture is made with a sterile needle or lancet and the first drop of blood wiped away. A second drop is now squeezed out and allowed to remain exposed to the air until the slide is breathed gently upon by the operator, when the tip of the drop of blood is gently pressed upon the surface of the slide which has been breathed upon. The cover-glass is then immediately placed over it, and the preparation is ready to examine. The slight exposure to the air, and the small amount of moisture upon the slide caused by breathing upon it, seem to hasten ex-flagellation, for specimens so prepared almost invariably contain flagellated bodies. C. F. Craig (N. Y. Med. Jour., Dec. 23, '99).

According to Manson, flagella constitute the first phases of the malarial parasite outside of man, and they represent parasites in sporulation the spores of which take on this special form of mobile and flagellated filaments "in the interest of the extracorporeal life of the plasmodium." Much the same view is entertained by Mannaberg, who believes that they represent a phase of the saprophytic existence of the parasite. Regarding their internal structure we possess no knowledge other than that imparted by Sacharoff, who considers the flagella as chromosomes originating in the nuclei of the body of the parasite, while the flagellation he regards as a process of perverted karyokinetic division accomplished in a violent manner.

Frequently in slides of the blood of infected crows there appear, after standing from twenty to thirty minutes, elongated motile forms such as were described by Danilewsky as vermiculi in his "Parasitologie Comparée du Sang"; and in order to trace their origin it is necessary to observe closely the changes in the other forms seen in the blood. Only the mature forms of the organism are seen to undergo any changes in the fresh slide of blood, the half-grown and younger forms remaining unchanged for a long time. The mature forms become rounded off, and are extruded from the corpuscle, which remains as a shadow in the plasma.

Both in the fresh and in the stained specimens of blood there can be seen differences which sharply distinguish two forms of the organisms. The forms are identical in outline, but the protoplasm of one is granular and opaque as compared with the clear hyaline protoplasm of the other. This distinction is well brought out in the stained specimen, in which the hyaline form remains almost entirely unstained, while the other takes on a well-marked blue stain with methylene-blue. Of these it can be determined that the hyaline forms alone become flagellated.

These two forms, then, become ex-

truded alike from the corpuscle and lie free in the plasma, but generally only a very short time elapses before the hyaline forms become flagellated, according to the process so often and so accurately described by workers on malaria. The granular forms lie quiet beside the nuclei and shadows of the red blood-corpuscles that lately contained them, but are soon seen to be approached by the flagella, which, having torn themselves away from the hyaline organism from whose protoplasm they were formed, struggle about among the corpuscles. These flagella, which so concentrate their protoplasm as to form a head, swarm about the granular spheres, and one of them plunges its head into the sphere and finally wriggles its whole body into that organism. Immediately on the entrance of this flagellum it seems to become impossible that another should enter, for they may be watched circling about, vainly beating their heads against the organism. The flagellum which has entered continues its activity for a few moments and the pigment of the organism is violently churned up. Soon it becomes quiet again, and remains so for from fifteen to twenty minutes, when a conical process begins to appear at one side of the organism, the pigment collecting mainly to the opposite side. This process grows larger and the pigment becomes more and more condensed, until finally we have a fusiform organism with a small spherical appendage crowded with pigment at one end. The other end is hyaline, and the pigment-granules which are not crowded into the small appendage are distributed superficially over the posterior part of the body. This spindle-shaped organism moves forward with a gliding motion, sometimes turning at the same time on its long axis, sometimes going through amœboid contortions. Red corpuscles lying in its path are either punctured by the hyaline anterior end, so that the hæmoglobin is enabled to escape into the plasma, or passed over and dragged along by the adhering posterior extremity.

In an intense infection a great destruction of corpuscles occurs; thus in a fresh slide after standing some time even

leucocytes may fall victims to the destructive force of these organisms, which have been seen to dash through them, scattering the granules into the plasma. As to the ultimate fate and true significance of these forms nothing definite can as yet be stated. In the slide they keep in motion for a long time, but finally quiet down and disintegrate. The idea suggests itself from their great power of penetration that they may be the resistant forms that escape from the body during life into the external world. The whole process described above seems to be a sexual process analogous to the sexual process seen in the lower animals and plants which occurs under unfavorable conditions and results in the formation of a resistant "spore."

Recently blood of a woman suffering from an infection with the æstivo-autumnal type of organism in which a great number of crescents were to be seen. These, in the freshly-made slide of blood, with very few exceptions, retained their crescentic shape or only a few minutes (this activity in the change of form varies greatly in specimens of blood from different patients). They soon drew themselves up, thus straightening out the curves of the crescent, while shortening themselves into the well-known ovoid form. After the lapse of from ten to twenty minutes most of them were quite round and extracorpuseular, the "bib" lying beside them as a delicate circle or "shadow of the red corpuscle." After from twenty to twenty-five minutes certain of the spherical forms became flagellated; others, and especially those in which the pigment formed a definite ring and was not diffused throughout the organisms, remaining quiet and did not become flagellated. The flagella broke from the flagellated forms and struggled about among the corpuscles, finally approaching the quiet spherical forms. One of them entered, agitating the pigment greatly, sometimes spinning the ring about; the remainder were unable to enter, but swarmed about, beating their heads against the wall of the organism. This occurred after from thirty-five to forty-five minutes. After the entrance of the flagellum the organism again be-

came quiet and rather swelled; but, although in the two instances in which this process was traced the fertilized form was watched for a long time, no form analogous to the vermiculus was seen. MacCallum (*Lancet*, Nov. 13, '97).

PHAGOCYTOSIS. — The destruction of the malarial organism is effected partly by the process of phagocytosis and partly by the germicidal properties of the blood-plasma, but the relative importance played by each is not, as yet, entirely clear. That the blood-plasma may possess this effect is well demonstrated by the destruction of the young spores after the exhibition of quinine. The cells chiefly concerned in phagocytosis are the large mononuclear and polymorphonuclear leucocytes and cells derived from the spleen, liver, and bone-marrow, termed macrophages, as well as from the endothelium of the blood-vessel walls. The process is to be best observed by the microscopical examination of the organs after death, although during life it may be satisfactorily studied in blood withdrawn from the spleen and, to a limited extent, in the peripheral blood. The phagocytes may attack the organism while it is contained within the red blood-corpuscle and envelop both host and parasite. The flagellate bodies appear to be objects of particular attack, together with extracorpuseular and various other degenerated forms. As just intimated, however, to the blood-plasma is to be ascribed an important part in the destruction of the parasites. This is confirmed by the fact that the greatest destruction of the parasites occurs at the time of sporulation, when the young organism is set free in the plasma, and by the further fact that it is at this period of the cycle of development that quinine exercises its greatest influence. We may conclude, therefore, that the destruction of the parasite is affected by the com-

bined action of the blood-plasma and the phagocytes.

The lymphocytes are never phagocytic in malaria. Those holding the opposite view have been misled by the fact that normally there exists a lymphocytic pigmentation which is, therefore, a physiological not a pathological condition. Patrick Manson (*Brit. Med. Jour.*, Sept. 24, '98).

MANNER OF INFECTION. — Since the discovery of the malarial parasite much work has been done looking to a solution of the problem of the manner in which infection of the body takes place and the channels through which the organism enters. This is one of the most important of the, as yet, unsolved problems relating to malaria, and until its solution is attained an effective prophylaxis cannot be hoped for.

It is agreed that infection may possibly take place by the entrance of the parasite through:—

1. The digestive tract (the water-theory).

2. The respiratory tract (the air-theory).

3. The skin (the inoculation-theory).

1. Although many believe that malaria may be conveyed into the system through the digestive tract by means of infected water, the weight of evidence is overwhelmingly against the probability that infection occurs by this channel. To prove it the experiment, to be conclusive, must be made upon a person who has had no previous exposure to malaria and who at the time must be removed from any other possible malarial influences, and after the administration of the supposedly-infected water the blood must be properly examined for the presence of the parasite.

[Celli (quoted by Mannaberg: *Nothnagel's Spec. Path. u. Ther.*, B. 2, T. 2, S. 94), in the Hospital of S. Spirito, Rome, caused several persons to drink

water derived from the pontine marshes and from the marshes in the regions surrounding Rome, for a number of days, and none of them developed malaria. Brancalone (quoted by Mannaberg: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 94) pursued the same experiment in Sicily with the same negative result. Zeri (quoted by Mannaberg: Nothnagel's Spec. Path. u. Ther., B. 2, T. 2, S. 94) caused nine persons to drink water derived from a malarious region for from five to twenty days; the dust derived from the evaporation of water from the same source he caused to be inhaled by sixteen persons; and to five persons he gave rectal injections of the infected water. None of the persons thus experimented with developed malaria. Norton (Johns Hopkins Hosp. Bull., Mar., '97), in a recent review of the subject, states emphatically that in his opinion malaria is not a water-borne disease. JAMES C. WILSON and THOMAS G. ASHTON.]

If the transmission of malaria is aërial only, there are certain localities close to sources of malaria the freedom of which from infection cannot be explained. Transmission by drinking-water considered as more probable. Malarious countries have been traversed with impunity by drinking only boiled water, while villages have witnessed the disappearance of fever as the result of a supply of pure water. Experiments of Marino, Leri, and Baccelli quoted, however, to show that the theory of water-borne malaria is not altogether tenable. Laveran (Presse Méd., Jan. 20, '97).

2. The view that the malarial parasite may enter the system by way of the respiratory tract is still entertained by many, who, in support of their belief, instance the supposed influence of the winds in conveying the infection. The evidence is decisive, however, that, although the winds may carry the malarial organism, the distance through which this is probable is a very limited one. Numerous instances are on record of the anchorage of ships a very short distance off the coast of highly-malarious districts

without any members of the crew, provided they do not land, contracting the disease. On the other hand, should members of such ship's crews land, infection almost invariably follows. Again, in many instances the moderate elevation of a residence, although surrounded by malarious swamps, will often prove effective in preventing infection; and it is well known that in a malarious district persons residing upon the ground-floor of a dwelling may become infected, while those residing in the upper stories will escape. Further, it is well recognized that the line of separation of certain malarious localities from the surrounding healthy region is, for some obscure reason, sharply defined: a circumstance which could not occur were the malarial parasite suspended in the atmosphere in such a way to be taken into the respiratory tract.

Investigation of the air in malarious regions, however, has given result that tend to confirm the theory. Maurel discovered in such air an amœba that he failed to find in non-malarious air, and the discovery of similar amœbæ in the nasal mucus he regarded as evidence that protozoa may be taken into the system by the respiration. Similar observations were made by Grassi and Calandruccio (Mannaberg), who discovered amœbæ in the nasal mucus of pigeons which for several nights they subjected to the exhalations from swamps or malarial earth.

It may be stated, however, that the evidence for and against the respiratory theory of infection is inconclusive, and that positive proof of either contention is still wanting.

3. Much attention has, of late, been given to the study of the skin as the probable channel through which infection by the malarial parasite takes place. It has been conclusively proved by in-

oculation-experiments that infection may take place through this structure, and in addition that the different varieties of malarial parasites have each a more or less definite period of incubation when infection is brought about in this manner. This fact has directed attention to biting insects—more particularly blood-sucking insects—as the means by which the infection may be carried from infected to uninfected persons. The most likely of such insects is, of course, the mosquito, and the manner in which it may act as the intermediate host has been the subject of much recent experimentation.

[The plausibility of the inoculation-theory is very much enhanced when comparisons are made between malaria and other parasitic blood-infections of man and the lower animals. It has recently been shown by Bruce, for instance, that the tsetse fly disease of Africa is due to a flagellate infusorium, and that the fly by feeding upon an animal already infected and then biting a healthy animal will act as a carrier of the parasite from the infected to the uninfected. In Texas fever, shown by Theobald Smith to be due to a protozoön, another illustration is afforded. In this disease the tick (*Boöphilus bovis*) acts as the intermediate host, the tick falling from infected animals gives birth to a numerous progeny, which, in turn, infect other animals feeding in the pasture. (Sternberg, American Surg. Bull., April 10, '97.) It is also well known that the *Filaria sanguinis hominis* is carried from the sick to the well by the mosquito.

There are many circumstances associated with the conditions under which malaria prevails that may be reconciled with the theory that the mosquito is an important factor in the transmission of the parasite. Thus, the relative immunity possessed by those sleeping in the upper stories of a dwelling in a malarious region is susceptible of explanation by the limited extent to which the flight of mosquitos is elevated above the ground. Also, from the lessened resistance offered

by the tender skin of children to the bites of insects may be explained the greater frequency with which they are infected by malaria in comparison to adults. It is only fair to state, however, that the advocates of the theory of infection by the respiratory organs explain the greater liability of children as being due to the fact that they are nearer to the ground than those of greater stature and are therefore exposed to the infection in a more concentrated form. The fact that sleeping upon the ground in a malarious region renders a person particularly liable to infection may be for the reason that he is thereby in a position most likely to be bitten by insects. Further, it is well known that mosquitoes are unlikely to leave the region in which they are generated, and that as soon as a strong wind prevails they seek such shelter that the wind carries them for a limited distance only. This may explain the very short distance malaria is carried by the winds.

Many interesting and valuable experiments have recently been made relating to the part played by the mosquito in the transmission of the malarial parasite. L. H. Warner (N. Y. Med. Jour., vol. lxviii, No. 24, Dec. 10, '98), in the study of this subject, bacteriologically examined various specimens of water obtained from the marshes of different malarious regions. In each specimen he found one or more forms of spirilla. These spirilla, however, produced no growth when introduced into culture-tubes of blood-serum and kept in an incubator from twenty-four to twenty-eight hours. Human blood was then collected from a number of persons by means of a sterilized hollow needle connected with the bulb of a syringe, also sterilized, and at once transferred to a blood-serum culture-tube, which was then placed in a thermostat and kept at a temperature of 100° F. A number of mosquitoes were then collected and kept in a sterilized bottle. From these by means of a platinum needle he extracted some of the albuminous poison with which mosquitoes are charged, and inserted some of it in each of the blood-serum cultures, which were then replaced in the thermo-

stat. Examination made after twenty-four hours revealed a parasite not to be differentiated from the malarial parasite. As a result of these experiments he believes the mosquito to be an important factor in infection.

Most important results in this field have very recently been obtained by Bignami (Lancet, Dec. 3, 10, '98), whose investigations have proved conclusively that at least the most important method of transmission of malarial infection is by inoculation through the agency of the mosquito. Bignami's earlier experiments yielded only negative results, and experiments conducted as recently as August, 1898, failed to give a positive reaction. Investigations conducted by Ross, working in Calcutta, proving that the "dappled-winged" or gray mosquito is the only one concerned in the infection of birds with the *Proteosoma coccidia*, as well as the demonstration by Bignami, Bastianelli, and Grassi of the development of crescents in the middle intestine of a particular species of mosquito (*Anopheles claviger*), forced Bignami to the conclusion that these inoculation-experiments failed because the proper variety of mosquito was not employed. Following the publication of an article by Grassi in September, 1898, establishing the fact that certain species of mosquitoes were found in malarious districts which did not exist in healthy regions, Bignami repeated his experiments with mosquitoes obtained from highly-malarious districts. It is needless to mention that every assurance was had that the patients, the subjects of experimentation, had never been subjected to the possibility of malarial infection. The mosquitoes used in the first and unsuccessful experiments were found by Grassi to belong to the *Culex pipiens*, while those from which successful inoculations were obtained were identified as the *Culex penicillaris*, *Culex malariae* (so called), and *Anopheles claviger*, these latter species being those found by Grassi in malarious regions, the *Culex pipiens* being the predominating species in regions non-malarious.

Bignami's experiment was begun on September 26, '98, and on November 1st

following the patient was seized with a severe chill. The subsequent symptoms were those characteristic of an æstivo-autumnal infection and the success of the experiment was fully demonstrated by finding in the blood the æstivo-autumnal parasite. JAMES C. WILSON and THOMAS G. ASHTON.]

At the present time there are only two theories as to the mode of transmission of malarial infection which are worthy of consideration,—namely, that it occurs aërially or else by inoculation through the agency of suctorial insects. Welch (Johns Hopkins Hosp. Bull., Mar., '97).

Mosquitoes not considered as essential for the conveyance of the parasites; they are not numerous in the fever-stricken districts on the West Coast; only appear for a short period in the year. Surg.-Capt. Duggan (Lancet, Mar. 27, '97).

While mosquitoes are almost confined to tropical and subtropical regions, malaria has a much wider area of incidence. A mosquito- and a malaria- map would be by no means correspondent in area, the former covering a much smaller tract of country than the latter. In seasonal charts, too, the occurrence of malaria would be, with spring and autumn rises, continuous; that of mosquitoes, or their representatives in temperate regions, would be intermittent. William Sykes (Brit. Med. Jour., Jan. 1, '98).

Transmission of malaria is by the mosquito. Infection occurs chiefly at night. Where there are no mosquitoes, there is no malaria. Thus there is a small island in German East Africa which is free of mosquitoes, and is also free of malaria. The Usamba region, at a certain height, is also free of malaria. It is also free of mosquitoes. R. Koch (Deutsche med. Woch., June 18, '98).

The malarial parasite cannot be dependent upon man for its existence, because it is sometimes present in regions that were previously uninhabited. This cannot be explained by simply stating that the plasmodium lives and multiplies in the soil, and that man is merely an accidental host, for it would then be difficult to see how such a soil-parasite could adapt itself so perfectly to an animal organism, such as that of man; and it

cannot be assumed that a mosquito or a gnat may serve as the host, for the introduction of one malarious patient into a district will not suffice to start an epidemic of the fever unless the suitable mosquito is at hand to carry the disease about. Andrew Davidson (Edinburgh Med. Jour., Oct., '98).

The malarial parasite possesses an extracorporeal cycle, which is completed in the stomach-wall of mosquitoes of the genus *anopheles*. Members of the genus *anopheles* can transmit malaria from infected to non-infected individuals.

At the present moment this is the only proved method by which malaria may be acquired. This theory explains most conditions associated with malarial infection; reports showing the protective efficacy of mosquito-nets even in the most malarial districts are rapidly accumulating; there is no serious evidence in support of any other theory.

The evidence at present possessed tends to favor the theory that the mosquito can acquire the infectious agent only from man. The statement is often made, that in tropical Africa, for instance, exploring parties may spend considerable periods of time in the uninhabited interior without illness, even though the regions may appear, from outward conditions, most unhealthy. It is only on their return to the sea-coast to districts where the surroundings would appear to be better, that the outbreaks of malaria occur. This hitherto inexplicable fact becomes clear if one assumes that in the woods, though all conditions are present for a spread of the disease, the mosquitoes are unaffected, and, therefore, harmless; it is only on coming back to the settlement where infected mosquitoes occur that the disease breaks out. Studies by Celli and Delpino, by Grassi, by Bastianelli and Bignami, of epidemics in small communities, have shown that the vernal cases of malaria are almost all relapses; that during the month of June the *anopheles* begin to be active; that about a month after the beginning of the activity of the *anopheles* the true epidemic of malaria begins, starting apparently in foci about individuals who have recently suffered from relapses of

the disease. During the season in which *anopheles* prevail the malarial epidemic flourishes, only to disappear again with the disappearance of the mosquitoes. W. S. Thayer (Phila. Med. Jour., May 5, 1900).

Specimens of *anopheles* collected from 173 localities, in many of which malaria has never existed. Conclusion that the coincidence of the geographical distribution of ague and *anopheles* as claimed by Grassi for Italy, and probably holding good for other countries, is disproved for England, and that the generalizations are proved to be premature whereby he excludes other blood-sucking insects from being possible hosts of malarial parasites on the strength of this geographical concordance, and furthermore that the disappearance of ague from Great Britain does not depend upon the extinction of mosquitoes capable of harboring the parasites of malaria. Nuttall, Cobbett, and Pigg (Jour. of Hygiene, Jan., 1901).

After feeding 57 specimens of *anopheles* on a patient suffering from malaria whose blood contained crescents, 27, or 47.5 per cent., were found to be infected. These 57 mosquitoes had fed 129 times on the patient, and out of the 129 feedings infection of the mosquitoes resulted in 46 instances, or 35.5 per cent. Man appears to be the only intermediate host of the malaria parasites. C. W. Daniels (Brit. Med. Jour., Jan. 26, 1901).

Outbreak of malaria in Middleburg, Zeeland, where for thirty years this disease had never appeared, in which the following facts were ascertained: It consisted only of cases of tertian fever, house epidemics were often observed, and it turned out that numerous *anopheles* were found, especially where stables containing rabbits, horses, etc., were placed. Infection experiments proved successful, and, of 22 mosquitoes that had sucked blood containing gametes from a patient, the parasites were found in 18 *anopheles*. Van der Scheer and Van Berlekom (Brit. Med. Jour., Jan. 26, 1901).

The *anopheles* personally found always in buildings, oftenest in recently used bedrooms, and especially in the

dwelling of the poor. The female begins to bite early in March, and they have been met as late in the fall as November 6th. The time of development from egg to adult is not more than nineteen days. While inoculation of *Anopheles quadrimaculatus* with tertian parasite was successfully obtained, infection in man from the bite of a single infected mosquito was not. The period of incubation between the bite and chill was exactly fourteen days. W. H. Berkeley (Med. Record, Jan. 26, 1901).

There is no proof that the adult mosquito is able to survive the rigors of winter in a state of hibernation, and that, as generally thought, when the season becomes warm turns active, lays eggs, and so provides for the perpetuation of the species.

From observations made—the extreme prolongation of the larval stage and the power shown by the larvæ to withstand low temperatures—it seems reasonable to infer that it is really the larvæ that provide for the continuation of the species through winter in these northern countries, and probably throughout Europe. It is during winter that one may hope to do most toward exterminating mosquitoes. Larvæ could be searched for and found with greater ease than those mosquitos that are said to hibernate in out-of-the-way corners.

Kerosene-oil is a most efficient larvicide. The usual directions are that the oil should be applied and renewed from time to time. This intermittent application, however, is not right. Better results would follow by suspending a vessel containing the kerosene-oil over the water, and arranging for the discharge of oil a drop at a time, the outflow being regulated so that there would be a continuous film of oil on the surface of collections of water near dwellings that cannot either be drained off or filled in. M. J. Wright (Brit. Med. Jour., Apr. 13, 1901).

Successful experiment on self, as a result of the bite of mosquitoes infected in Rome on a case of benign tertian ague. The first symptoms of a double tertian fever appeared after an incubation period of between ten and sixteen

days and lasted four days, when the presence of the parasite was fully ascertained. P. Thurnburn Manson (Brit. Med. Jour., July 13, 1901).

In a native Indian population in a malarious region, while the adults may be perfectly free from the disease, an enormously large percentage of the young children contain the parasites in their blood. Though the disease appears to be much less dangerous to the native children than to new arrivals, implying that they have a degree of congenital immunity, the parasites in the young natives are perfectly able to cause dangerous fever in white people, when conveyed to them by mosquitoes. Hence the important practical inference that white people settling in a malarious tropical region should not, as they now commonly do, plant their houses near native settlements, but place them at some considerable distance from them, about a quarter of a mile being apparently sufficient. Lister (Indian Med. Record, July 17, 1901).

The etiology, prophylaxis, and treatment of malaria studied from two points of view. First, the circumstances bearing on the introduction of the parasite into man; second, the circumstances affecting the development of the clinical manifestations of malarial infection. Under the first head, the knowledge that certain species of mosquito are the necessary media for malarial infection has enabled us completely and satisfactorily to explain many facts which hitherto eluded us—such, for instance, as the long-recognized association of malaria with high atmospheric temperature and paludal conditions. The danger of being out of doors at night in malarial countries is explained by the habits of mosquitoes, which are mainly nocturnal. The value of the mosquito-net and similar contrivances, of smoke, and of fire as protections from malaria are explained by the circumstances that these things keep the blood-sucking insect at a distance. The etiology of malaria, therefore, resolves itself in a great measure into the study of the natural history of certain species of mosquito. Especially the genus *Anoph-*

les, which so far has been the only variety definitely proved to serve for the transmission for the parasite.

The leading facts in the life of a mosquito are as follows: The egg deposited on still water floats on the surface or becomes attached to vegetation at the margin of the pool. In about two days a minute larva is hatched out and at once proceeds to feed greedily upon the organic materials suspended in the water. It grows rapidly and finally assumes the pupa form, from which the perfect insect presently emerges. The duration of aquatic life varies with different species, and is affected by the temperature of the water. In cold weather the development is entirely suspended. This hibernation of the larva is one of the ways by which the cold season is bridged across and the species carried over from summer to summer. The insect remains quiet during the day, feeding at night. The male is in most instances purely phytophagous. The female *Anopheles* even in confinement will accept a meal of blood every two or three days. About twenty days after birth she deposits some one hundred and fifty or two hundred eggs, an operation repeated every few days so long as conditions are favorable. The entire cycle from egg to egg occupies about fifty days. It is calculated that a single female will give rise in four generations to a progeny of two hundred million. In confinement the mosquito has been kept alive for two months. Man is the great source from which the mosquito obtains the parasite. Young subjects are especially susceptible, individual susceptibility being innate or acquired. Very few individuals are absolutely immune to the disease. Patrick Manson (Practitioner, March, 1901).

Cultivation of the æstivo-autumnal malarial parasite in the mosquito (*Anopheles quadrimaculata*) during the past winter and summer. In the neighborhood of the League Island Navy Yard, Philadelphia, on June 19, 1900, the author found both the larvæ of the *Anopheles quadrimaculata* and the *Anopheles punctipennis* near a house where a case of malaria developed. From

June 19, 1900, to November 11, 1900, he collected larvæ of the *Anopheles* and raised 200 adult mosquitoes. He also visited many infected localities, and always found that where there is malaria there are mosquitoes. The reverse, however, does not hold, for where there are mosquitoes there are not always cases of malaria. He found some larvæ of *Anopheles* in the Pocono Mountains of Pennsylvania. A number of observations were conducted to see whether the *Anopheles* collected around Philadelphia were susceptible to the infection from the malarial parasite. In only one out of ten observations did he find zygotes in the middle intestine of one mosquito. Woldert (Jour. Amer. Med. Assoc., March 2, 1901).

The mountains of Honduras, four thousand feet above the sea-level, are above the mosquito-belt and above the fever-belt, and yet malarial fever, both of the quotidian and tertian types, is of common occurrence. It is propagated, at least in part, by fleas. J. H. Egbert (Medical Record, Aug. 17, 1901).

Experiments were made in a large gauze tent which had been erected within a disused photographic establishment, the one end of the tent ending against large windows, into which the sunlight poured on bright days. Large stone basins were placed on the floor for the *Anopheles* to breed in, the stock being renewed from time to time.

It was noticed at the beginning that when one entered the tent in dark-gray clothes the imagos frequently flew up and settled on the dark cloth, but that they never did this when the person entering the tent was clothed in white flannels. To test the influence of color, a number of pasteboard boxes were taken which measured 20 centimetres by 16 centimetres, and had a depth of 10 centimetres. The boxes were lined with cloth, having a slightly roughened surface, to which the insects could comfortably cling. All of the fabrics had a dull surface, and each box was lined with a cloth of different color. The boxes were placed in rows upon the floor and upon each other in tiers, the order being changed each day after the

observations had been made. The interior of the boxes were moderately illuminated by light reflected from the surface of the white tent. On 17 days during a month, beginning with the middle of June, the number of flies which had accumulated in the boxes were counted. Counts were actually made on 17 sunny and cloudy days, and with the following result:—

Color of Box.	Number of <i>Anopheles maculipennis</i> Counted in each Box during Seven- teen Days.
Navy blue	108
Dark red	90
Brown (reddish)	81
Scarlet	59
Black	49
Slate gray	31
Dark green (olive)	24
Violet	18
Leaf green	17
Blue	14
Pearl gray	9
Pale green	4
Light blue (forget-me-not) .	3
Ochre	2
White	2
Orange	1
Yellow	0

512

Dark blue was most attractive, the other colors being less and less attractive in the order of numbers given. A marked fall in the number of insects resting in the boxes begins with the "blue" box; the color in this case was a rich, full blue. Pale green, light blue, ochre, orange, and yellow, especially the last two colors, seemed to repel the insects.

It is true that the *Anopheles* bite more frequently during twilight and at night, but the choice of clothing having a repellent color should afford a measure of protection against the insects which may bite during the day-time. In any case the number of insects congregating in dwellings might very well be lessened by the choice of colors of a suitable character applied to the walls. Some sort of trap might readily be de-

vised, lined with a suitable color, such as dark blue, within which the insects could congregate and easily be destroyed in considerable numbers. G. H. F. Nuttall (Brit. Med. Jour., Sept. 14, 1901).

Epidemic of malaria that occurred in a region previously free from that disease along the North Sea. The author traced the epidemic to a body of Dutch laborers that were excavating and building dikes. Some of these were infected, and came from an infected region, and the epidemic appeared in the region in which these workmen were at the time located; it developed after the appearance of warm weather and the arrival of mosquitoes. The disease followed the infected persons from the original point to other regions round about, and the *Anopheles* were found in considerable numbers in all the places in which malaria appeared. Martini (Deutsche med. Wochen., Oct. 30, 1902).

Series of experiments upon the artificial transmission of malaria by the mosquito. Healthy persons can be infected by the sting of the *Anopheles* mosquito which has been allowed to suck blood containing crescents capable of further development, if the insects be kept in a thermostat under suitable conditions. The sting of a single insect is sufficient to infect. Since all persons experimented upon acquired malaria, the question of an immunity could not be settled. The time between the inoculation and the appearance of the first symptoms varied from seven to eleven days and the statement of certain authors that malaria can be acquired in so short a period as half an hour is discredited. In no case did the disease begin with a definite chill, but the fever, at first slight, gradually increased in intensity, which seems to show that a constant multiplication of the parasites is going on in the blood and that a large number is necessary for a chill. The variations in the period of incubation did not necessarily stand in relation to the number of *Anopheles* by which the individual was bitten, but other unknown factors must be drawn into con-

sideration. During incubation absolutely no subjective symptoms were noticed. The condition of the spleen was not constant; in some it was swollen before the first rise of temperature; in others it could be felt only after the fever. The type of the malaria artificially induced always resembled that of the patients from which the mosquitoes were allowed to obtain their crescents and the same parasites were always found. The peripheral blood at the beginning of the illness never contained any crescents. S. Purjesz (Wiener klin. Rund., April 20, 1902).

Series of military experiments have been carried out by the Japanese government on the Island of Formosa, the results of which furnish a most conclusive demonstration of the relations between mosquitoes and malaria. A battalion of soldiers who were completely protected from mosquitoes for 161 days during the malarial season escaped the disease entirely, whereas there were 259 cases of malaria in another battalion, in the same place and during the same length of time, which was not protected from mosquitoes. (New York Med. Jour., March 29, 1902).

The most important question now to decide is as to whether the gnats which do not belong to the genus *Anopheles* are or are not concerned in the propagation of malaria, and why certain individuals of one species of gnats are more dangerous than others. For instance, the researches of Stephens and Christophers demonstrate that the *Anopheles Rossii* may be almost excused as an agent of malaria. His own personal experience of three years' constant attention to the subject, in countries so different as water-logged Assam and Lagos, on the one hand, and arid Ismailia, on the other, has led him to believe that the best personal prophylaxis is the ordinary mosquito-net during sleep, and to this he adds the prophylactic administration of quinine when the danger is especially great. As mosquitoes seldom bite in the open air it seems an unnecessary policy to avoid them there, but he praises very highly the use of the punkah or the electric

fan, together with the wholesale removal of breeding-places of all kinds of mosquitoes. Major Donald Ross (Egyptian Medical Congress; Medical Record, March 28, 1903).

Whatever views may be entertained regarding other channels of infection, the following statement of Bignami well expresses the present *status* of the subject. "This much, at any rate, we can assert, namely: that inoculation is the only mechanism of infection which has been demonstrated experimentally."

General Symptomatology.

PERIOD OF INCUBATION. — No fixed period of incubation can as yet be given to malaria acquired in the natural way. While in the majority of cases it would appear to average from six to fourteen or twenty days, yet instances have been reported in which the disease developed within a few hours after exposure to the infection, and still other instances in which the evidences of infection did not occur for weeks or months after exposure. In the former class of cases, as studied by Plehn, the earliest evidences of supposed infection consisted of a single paroxysm immediately after exposure, no other paroxysms being experienced for several days subsequently. At the time of the first paroxysm examination of the blood yielded negative results, the parasite not being discovered until the paroxysms recurred, some days later. Instances of prolonged incubation are susceptible to the explanation that they are, in all probability, cases of relapses of earlier attacks that have been characterized by manifestations so mild as to be overlooked.

In view of our present knowledge of malaria some degree of variation in the length of incubation may readily be accounted for by the varying periods required for the development of the different forms of parasites. Further, inas-

much as the clinical manifestations of the disease begin when the parasite has developed into a group sufficiently large to produce a reaction at the time of sporulation, the period of incubation will also vary in accordance with the number of parasites originally introduced into an individual. This partial dependence of the duration of the period of incubation upon the number of parasites producing the infection is well shown in the cases in which infection is artificially brought about by inoculation.

Inoculation-experiments as determining the duration of incubation of malaria have been of much interest, and the varying results obtained in infection by the different forms of parasites correspond to the differences noted in cases that occur spontaneously.

[Mannaberg makes the following deductions from the results of his experiments: In five cases inoculated with the quartan parasite the minimum period of incubation was 11 days, the maximum period 18 days, and the mean period 13.4 days.

Seven cases inoculated with the tertian parasite showed a minimum incubation-period of 6 days, a maximum of 21 days, and a mean of 11 days.

Seven cases inoculated with the æstivo-autumnal parasite (with amœbæ, but without crescents) gave a minimum period of incubation of 3 days, a maximum of 14 days, and a mean of 6.5 days; while two cases inoculated with crescents without ("probably a few") amœbæ gave an incubation period of 13 and 15 days, respectively, or a mean of 14 days.

JAMES C. WILSON and THOMAS G. ASHTON.]

These experiments indicate that the longest periods of incubation are associated with the milder forms of infection, and that the grave infections, the æstivo-autumnal, show the shortest periods. In both instances inoculation-experiments coincide with clinical experience, and render easy of belief the probability

that in the malignant cases of æstivo-autumnal infection the incubation may be brief.

CLINICAL TYPES.—Mannaberg divides the malarial fevers into two main groups: (1) the fevers due to infection with the ordinary tertian and quartan parasites of Golgi; (2) the fevers due to infection with the æstivo-autumnal or crescent-forming parasite.

Under these two main groups, which may also be termed, respectively, the regularly intermittent fevers and the more irregular, often continued or sub-continued, fevers, may be differentiated three separate types of fever: 1. Tertian fever, single and double infections. 2. Quartan fever, single, double, and triple infections; both types comprising the first group of fevers. 3. The second group of fevers, the æstivo-autumnal.

Tertian fever is of common occurrence in almost all malarial districts. The quartan type, while the common fever in a few malarial regions, such as certain parts of Sicily, is in most regions, where other varieties of infection are common, of rare occurrence. The following table is given by Mannaberg to illustrate the infrequent occurrence of this type in different parts of the world:—

Reporter.	Place.	Cases of Malaria.	Cases of Quartan Type.
Maillot.....	Bône, Algiers..	2338	26
Finot.....	Blidah.....	4211	21
Durand de Lunel	Tenès.....	625	6
Osler.....	Baltimore.....	616	5
Laveran.....	Algiers.....	311	7
Griesinger.....	Tübingen.....	414	3
Mannaberg.....	Vienna.....	144	4

Æstivo-autumnal form of severe grade predominates in tropical and subtropical regions, and as these regions are departed from appears only in the late summer and autumn months; while the less severe forms, tertian and quartan fevers, occur earlier in the season.

Tertian Fever.—SINGLE INFECTION, OR TERTIAN INTERMITTENT FEVER.—In this form of fever the infection is with a single group of tertian parasites, each individual member of which is in approximately the same stage of development; so that segmentation of all, with which the paroxysm is associated, takes place at about the same time. As already stated, the time necessary for the completion of the cycle of development of the tertian parasite is about forty-eight hours, sometimes a little more, sometimes a little less, the latter more commonly than the former.

THE PAROXYSM.—The paroxysm may be divided into three stages: the chill, the fever, and the sweating stage.

The Chill.—Unpleasant feelings, ill-defined sensations of discomfort, usually precede the chill, and in an individual who has ever experienced a malarial outbreak are peculiarly significant of what is about to follow. Even at this time some elevation of the temperature may be noted. Occasionally the onset is abrupt and without premonitory manifestations. Gradually the chill develops from chilly sensations up and down the back early in the paroxysm until the fully developed rigor is attained. There is then chattering of the teeth and general shaking of the body, often so violent as to shake the bed upon which the patient is lying. While the surface of the body is cold, and the skin, owing to the erection of the hair-follicles, presents the condition of goose-flesh, the internal temperature, as determined in the rectum, is high, often 105° or 106° . The skin is pale, often bluish in color, and visual disturbances, headache, dizziness, nausea, and vomiting are common. The pulse is tense, small, and accelerated. The quantity of urine is increased. The duration of the chill is variable, usually from ten

minutes to half an hour, or an hour, or even longer.

The Fever.—The febrile, or hot, stage gradually supervenes upon the stage of chill, until by repeated flushes of heat the stage of chill is completely superseded, and the patient throws off the additional bed clothing which a short while before was so gratefully accepted. The skin becomes hot, dry, and reddened, and a sense of burning heat is complained of; the conjunctivæ are suffused; the pulse rapid, full, and bounding; intense headache, dizziness, and noises in the ears are often complained of; thirst, restlessness, and occasionally delirium occur, or the patient may be drowsy and somnolent. Constipation is generally present; epistaxis, diarrhoea, and vomiting are among the less frequently occurring symptoms. Cutaneous manifestations are of common occurrence, more particularly herpes of the lips and nose, while erythema and urticaria are sometimes seen. In most cases the splenic tumor may readily be detected. The duration of this stage is usually four or five hours, and the temperature now attains its greatest elevation.

The Sweating Stage.—With the initiation of this stage the patient experiences great relief. At first perspiration is noticed to occur about the forehead and upon the face, but shortly spreads over the whole body, usually becoming most profuse. The temperature rapidly falls, so that in two or three hours it has reached a subnormal point, where it generally remains for some time. Great relief from the distressing symptoms of the preceding stages is experienced, the pulse rapidly lessens in frequency, and the patient sinks into a refreshing sleep.

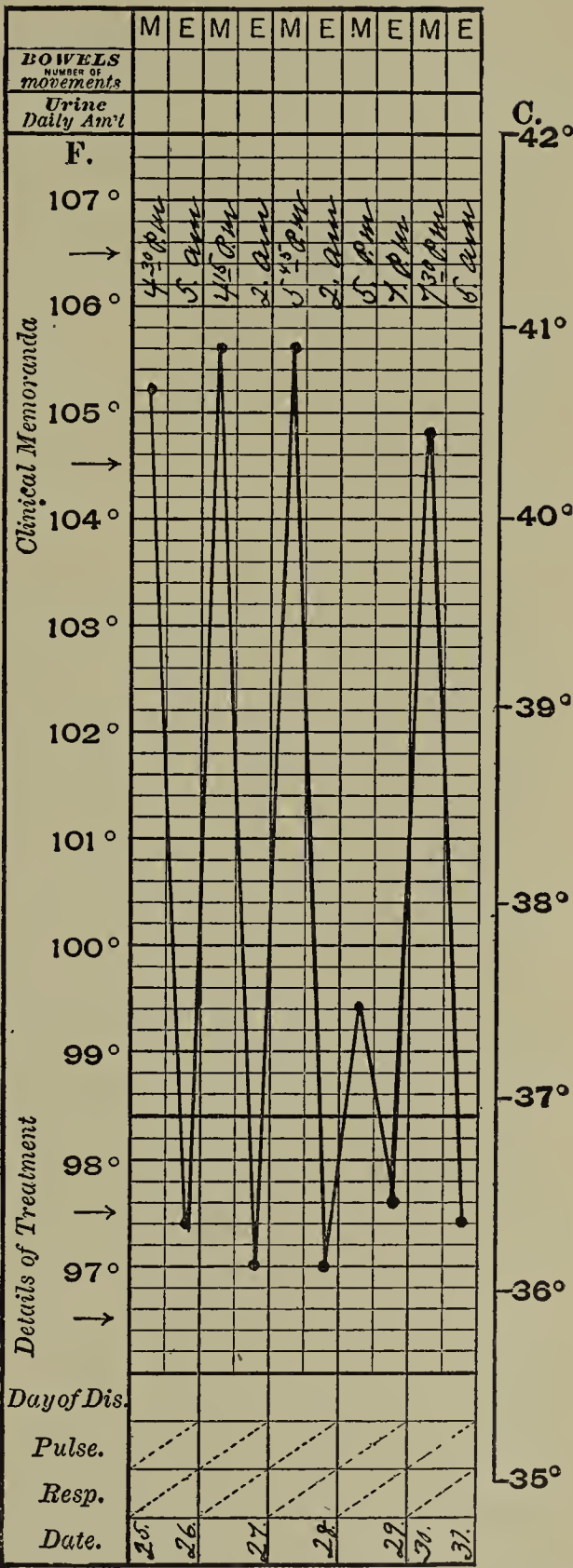
The Intermission.—The intermission continues until the young parasites de-

rived from the segmentation that has caused the first paroxysm have, in their turn passed through their cycle of development until the stage of segmentation is attained, and with it occurs the second paroxysm. The time thus occupied is forty-eight hours, longer or shorter, resulting in anticipation or retardation of the paroxysm. During the intermission the temperature remains subnormal for some hours and the patient experiences great relief.

DOUBLE INFECTION OR QUOTIDIAN INTERMITTENT FEVER.—In the blood will be found two groups of tertian parasites in different stages of development and reaching maturity or the stage of segmentation upon alternate days. In consequence, quotidian or daily paroxysms occur, which do not differ in their clinical manifestations from the paroxysms incident to single tertian infection. Inasmuch as one group may be larger than the other at the time of infection, it is not uncommon for the paroxysms to be tertian in type until the smaller group has attained sufficient size to cause a paroxysm. Further, as one group may, throughout, be more numerous than the other, it is not uncommon for the paroxysms produced by this group to be more severe than those produced by the other. It is usual, also, for one group of parasites to undergo segmentation at a different hour from the other group, resulting, of course, in a constant difference in the hour of onset of the paroxysms.

Infection with multiple groups of parasites is so rare as to be of no clinical importance. Such an occurrence, of course, would give rise to a very irregular type of fever. (See temperature-chart.)

Quartan Fever.—**SINGLE INFECTION.**—The paroxysm in quartan fever is similar in every respect to that occurring in tertian fever. Examination of the blood



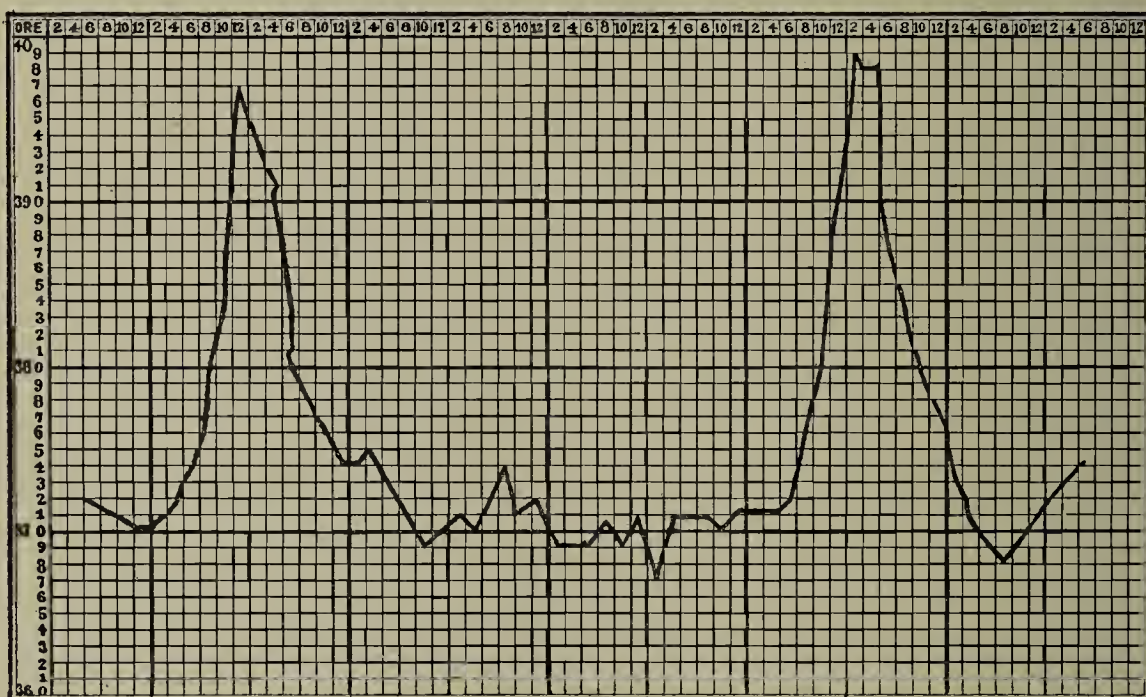
Temperature-chart of double tertian infection, quotidian paroxysms. (Philadelphia Hospital.)

shows the presence of a single group of quartan parasites the members of which are about in the same stage of evolution

and attain the stage of segmentation at about the same time. The time required for the completion of the cycle of development is about seventy-two hours; so that the paroxysms, coincident as they are with the segmentation of the parasites, occur every fourth day, an intermission of two full days existing between. The paroxysm is characterized by the three stages of chill, fever, and sweating, and are of an average duration of about ten or twelve hours. They occur with great regularity and show but little tendency

cessive days followed by a day of intermission, are in every respect similar to those occurring in single infection.

TRIPLE INFECTION OR TRIPLE QUARTAN FEVER.—This is due to the existence in the blood of three groups of quartan parasites in different stages of development and segmenting upon successive days. This results in daily paroxysms, or a quotidian intermittent fever, which only an examination of the blood will serve to differentiate from the quotidian intermittent fever due to infection with



Quartan simplex: Silvestrini. (*Mannaberg.*)

toward retardation or anticipation. (See comparative temperature-charts.)

DOUBLE INFECTION, OR DOUBLE QUARTAN FEVER.—This occurs when two groups of quartan parasites exist in the blood at the same time, and attain the stage of segmentation upon successive days. In this manner one day of intermission then follows. Upon examination of the blood the existence of these two groups can be readily observed. The paroxysms, which occur upon two suc-

cessive days followed by a day of intermission, are in every respect similar to those already described as occurring in the single and double infections.

Æstivo-autumnal Fever.—The most important particular in which the fevers of this group differ from the regularly-intermittent fevers is the marked tendency which they show to become pernicious. The regularly-intermittent fevers when untreated tend to spontaneous recovery, and rarely, except in the

most intense infections, develop grave, pernicious symptoms. The æstivo-autumnal infections, however,—of course with many exceptions in which the tendency to spontaneous recovery is seen,—pass on to a fatal termination with the development of pernicious symptoms when left to themselves.

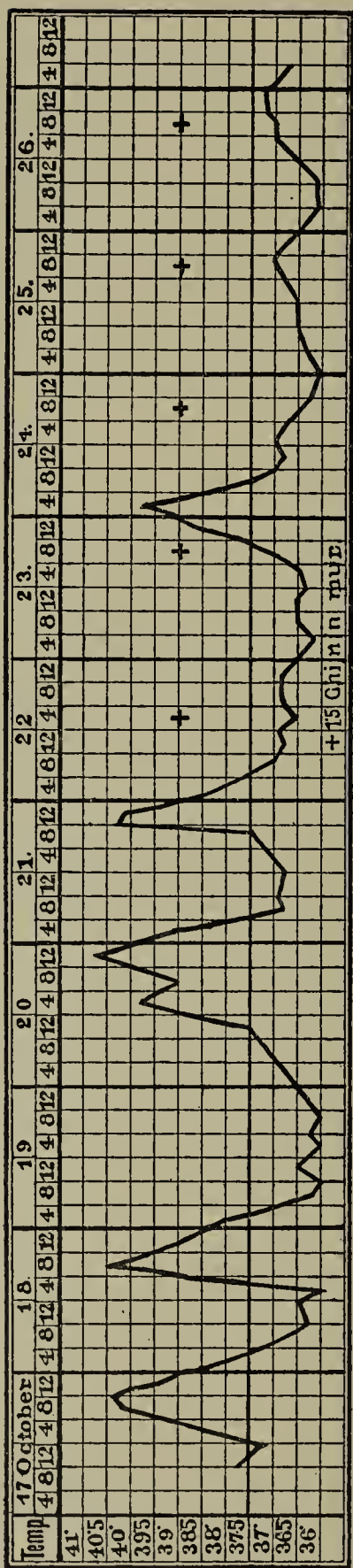
This group of fevers, of course, depends upon infection with the æstivo-autumnal parasite and clinically is to be observed in many forms. Two principal forms, however, may be recognized: *quotidian intermittent fever* and *æstivo-autumnal tertian fever*, or *malignant tertian fever*. Owing to the marked irregularity which is a characteristic of almost all æstivo-autumnal fevers, it is not always possible to sharply classify the various cases. The chief reasons for the tendency toward irregularity in this infection are: 1. The cycle of development of the parasites is not so nearly simultaneous in the different members of the group as it is in the regularly-intermittent fevers, and as a result sporulation is not completed in the short space of a few hours, but continues to occur for twenty-four to thirty-six hours. The consequence is the prolongation of the paroxysm. 2. The different parasites do not all take the same length of time to attain maturity, as is the case in the regularly-intermittent fevers, but show a marked tendency toward the hastening of sporulation, with resulting anticipation of the succeeding paroxysm. 3. Several generations, though seldom more than two, and mixed infections are of frequent occurrence. (Mannaberg.)

From a study of an outbreak of malignant tertian malarial fever, which occurred in a cavalry troop serving in the Philippines, the author concludes that the period of incubation is between ten and eleven days. Eighteen out of forty-five men in the troop were infected.

Jackson (American Medicine, July 9, 1904).

IN QUOTIDIAN INTERMITTENT FEVER of the æstivo-autumnal type the daily paroxysms may be so well defined that without an examination of the blood it may be impossible to differentiate it from double tertian or triple quartan infections. This is not the rule, however, for usually the paroxysm is much longer in duration, possibly twenty-four hours, while a chill may not mark the onset or may be very slight and not occur for some time after the temperature has become elevated. As a result of one of the causes just mentioned, after a few paroxysms the febrile movement no longer conforms to a type, but, from the prolongation of one of the paroxysms or the anticipation of the one succeeding, becomes so irregular that the interval marking the intermission becomes effaced or exists only as a slight fall in the temperature. (See temperature-chart.)

MALIGNANT TERTIAN FEVER, so designated by Marchiafava and Bignami to distinguish it from tertian fever of the regularly-intermittent type, is characterized by paroxysms occurring approximately every forty-eight hours. These observers describe the temperature-curve as possessing the following peculiarities: A rapid rise, frequently without a chill; with slight fluctuations the temperature remains high for several hours and then, not infrequently in the middle of a paroxysm, sustains a considerable drop, but not to normal (pseudocrisis); soon after, sometimes with a slight chill, the temperature again rises, often higher than it was at first, and after remaining there for some time finally falls to normal or below. The curve is thus divided by Marchiafava and Bignami into: the rise, the pseudocrisis, the precritical elevation, and the true crisis.



Quartan duplex. (Mannaberg.)

In the intervals between the paroxysms the temperature is frequently subnormal; inasmuch, however, as the paroxysms not

uncommonly last thirty-six hours, or more, these intermissions are of very short duration. Although the paroxysms may occur at intervals of longer duration than forty-eight hours, it much more frequently happens that anticipation of the succeeding paroxysms occurs, so that the periods of intermission become so short that the temperature-curve becomes almost continuous, interrupted only by slight depressions or remissions to mark the interval between the paroxysms. In this manner occur the so-called *malarial remittent fevers*. In consequence of marked prolongation of the paroxysms or decided anticipation of succeeding paroxysms, so that one paroxysm begins before the preceding one is completed, many cases show a temperature-curve that is *continuous*. Even in these cases, however, it is usual for the temperature to show slight fluctuations indicative of the termination and onset of the various paroxysms.

These cases of malarial remittent or *continued fever* pass into a condition closely resembling typhoid fever, and under the name of typho-malaria have been the source of much confusion in their proper differentiation from typhoid fever. At the present day, and from the foregoing description of the manner in which these cases occur, it seems unnecessary to call attention to their essentially malarial nature. These cases of æstivo-autumnal fever may suddenly develop pernicious symptoms at almost any period of their course. They frequently so resemble typhoid fever that the distinction between the two is only possible as the result of a microscopical examination of the blood. The patient may complain of headache and general body pains, or there may be decided delirium or mental hebetude and somnolence. Very grave cerebral symptoms may at

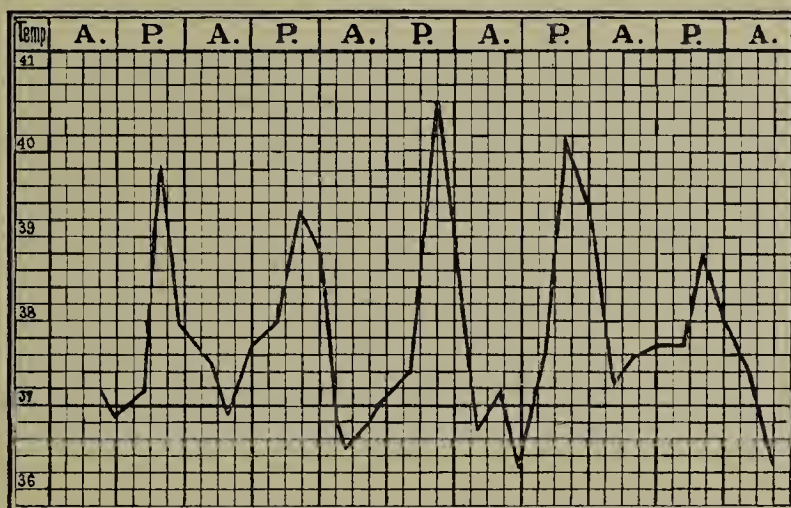
any time occur, such as stupor and coma; and convulsions, either general or local, may be observed. Intractable vomiting, jaundice, and profuse diarrhœa, together with a dry, coated tongue and a collection of sordes about the mouth complete the resemblance to enteric fever.

Of 79 cases of typhoid fever treated to conclusion during the sixth year of the Johns Hopkins Hospital work, there were 13 that began with shaking chills. In 2 cases there were several severe rigors, in 3 cases there were two, while in 8 the rigor was single. Osler (*Univ. Med. Mag.*, Nov., '95).

In a type of autumnal fever that appears annually between the 10th and 15th of August in Virginia, and continues

laria, or may be induced by it; and only such conditions should be classified as symptoms as are the common conditions existing in malaria—for example, chills followed by fever, headache, sweating, vomiting, epistaxis, herpes labialis, bronchitis, and albumin in the urine. All these occur sufficiently often to make them characteristic of malaria when a number are taken together. Rupert Norton (*Amer. Jour. Med. Sciences*, Feb., '98).

At the Johns Hopkins Hospital in Baltimore, where hundreds of cases of typhoid fever and of malarial fever are seen, many coming from the neighboring Chesapeake-Bay region and from the Southern States, the "typho-malarial" fever of Southern writers is unknown, and only



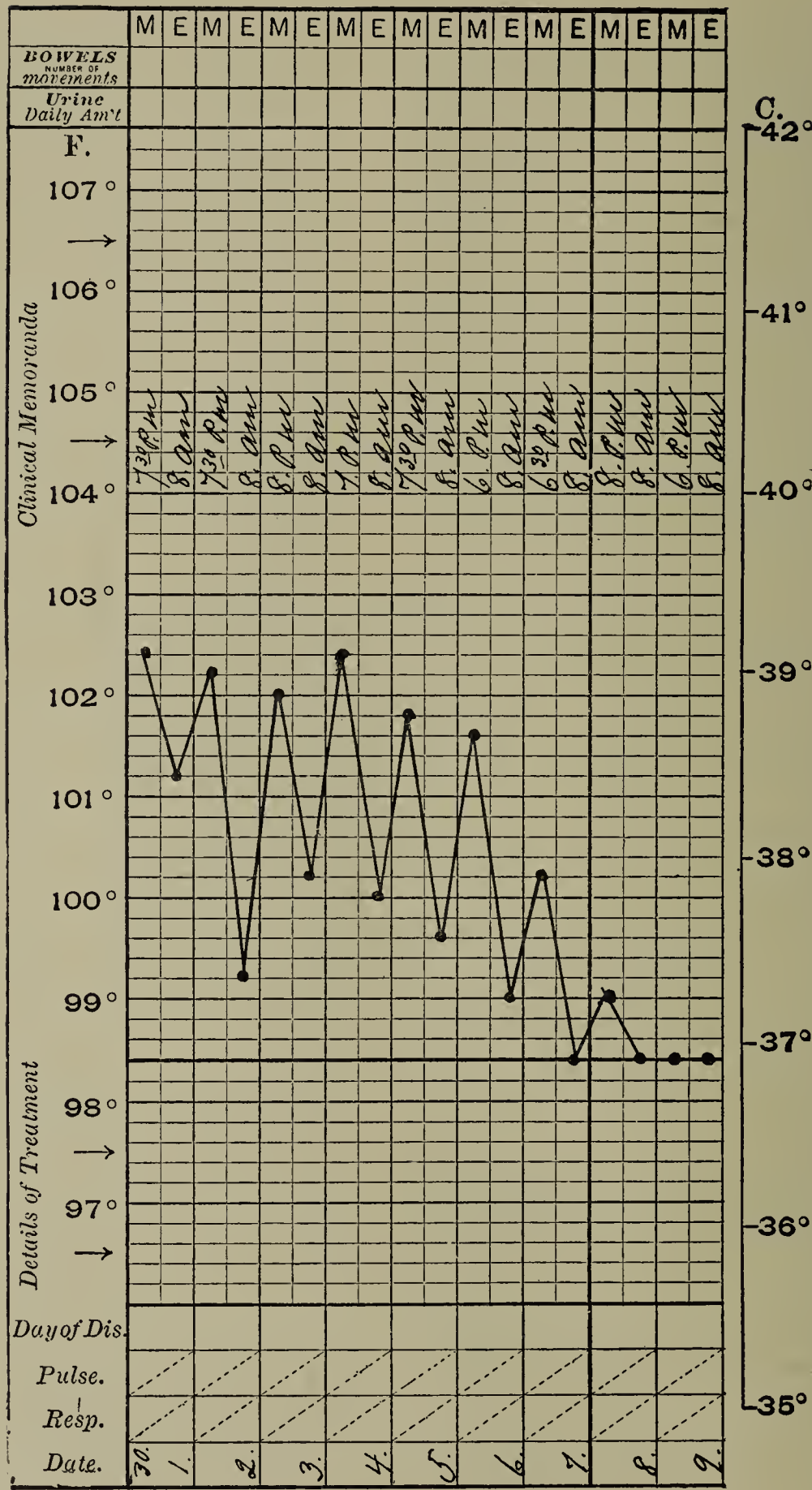
Quartan triplex: Marchiafava and Bignami. (*Mannaberg.*)

until hard frost has set in symptoms analogous to typhoid fever are often witnessed. The temperature-curve of this prolonged remittent type and that of typhoid fever are almost identical, while many of the prodromal symptoms are similar. There are, however, no iliac gurgling, no rose spots; no tympanites, but rather retraction of the abdomen; and no intestinal hæmorrhage. The only test is the recognition of the malarial parasite. Bedford Brown (*Charlotte Med. Jour.*, Jan., '97).

It is often hard to exactly differentiate existing conditions into symptoms directly associated with malaria and diseases consequent on malaria. Diseases may exist at the same time as the ma-

two cases of true combined typhoid and malarial infection have been seen. The reports from foreign countries in general are the same. I. P. Lyon (*Amer. Jour. Med. Sciences*, Jan., '99).

Particular mention must be made of those cases of æstivo-autumnal fever which are not characterized by a definite paroxysm and in which but a slight elevation of temperature occurs, and that irregularly. The patients in whom this irregularly-manifested infection occurs may complain only of headache, pain in the back and limbs, loss of appetite, and lassitude. This condition is, of course, accompanied by enlargement of the



Temperature-chart of æstivo-autumnal fever, quotidian paroxysms.
(Philadelphia Hospital.)

spleen, the characteristic malarial anæmia, and the presence in the blood of æstivo-autumnal parasites.

Pernicious Malarial Fever.—The development of pernicious characteristics in malarial infections depends probably upon one or more of several conditions. These predisposing factors are divided by Mannaberg into: (1) individual predisposition; (2) peculiarities of the parasites; (3) anatomical lesions.

1. There are persons who appear to possess a special predisposition to the development of pernicious symptoms upon exposure to infection, and who as often as they are taken ill with malaria develop the disease in one of its severe forms. It is probable that in such subjects certain peculiarities, either chemical or anatomical, may favor the elaboration of malarial toxins of more potent effect, or may influence the accumulation of infected blood-corpuscles within certain capillary areas. In others the predisposition may be temporary or acquired, as in alcoholics, those exposed to excessive heat, or bodily weakness incident to overwork and deficient nourishment. It has also been observed that certain conditions predispose to the reference of pernicious symptoms to certain organs. Thus, it is observed by Baccelli that those whose work exposes them to the sun's heat frequently develop the comatose form, and that the same is true of alcoholic subjects, while persons previously suffering from intestinal catarrh are very likely to develop the choleriform type. In a highly-malarious region strangers who are unaccustomed to the climate are much more likely to develop pernicious malaria than the natives or those who have become acclimated.

2. Pernicious malarial fever is invariably due to infection with one of the varieties of parasites belonging to the second, or æstivo-autumnal, group, and

of these varieties the one most frequently concerned, according to Marchiafava and Bignami, is the malignant tertian parasite. This being accepted as a fact, malignancy is found still further to depend upon the number of parasites existing in a given infection. In pernicious cases, while the number of parasites will be found to vary considerably, their number is always great. That the number alone is sufficient to explain malignancy many authorities dispute, and, while admitting the importance of their effect, the claim is made that pernicious symptoms arise in certain infections as the result of a higher degree of toxicity or virulency possessed by the infecting parasites.

3. The different anatomical lesions in pernicious malarial fever are sufficient to account for many of the malignant manifestations; these depend, for the most part, upon the occlusion of the lumina of the blood-vessels with the infected blood-corpuscles. Thus, by way of illustration, as a result of obstruction in the cerebral vessels numerous punctiform hæmorrhages ensue and grave cerebral symptoms occur.

Pernicious malarial fever may show itself as such from the very onset, and this is particularly so in highly malarious regions, or the occurrence of pernicious symptoms may be preceded by several ordinary paroxysms. From what has been said regarding the localization of the malarial parasites in the vascular system of certain organs, it may readily be understood that more or less distinct types can be differentiated. The most frequently occurring type is the comatose.

COMATOSE FORM.—In this form the earliest manifestation may be suddenly oncoming coma; unconsciousness is profound and respiration stertorous and irregular, so that in many instances a

striking resemblance to apoplexy is produced. More frequently, however, coma does not ensue until after the occurrence of one or more paroxysms uncomplicated with cerebral symptoms, or associated, perhaps, only with slight delirium and somnolence. Then, with deepening stupor or increasing delirium, coma supervenes. In other instances coma intermits, beginning with the elevation of temperature associated with the paroxysm, and ceasing with its decline, and this may repeat itself several times. In by far the greatest number of cases, however, coma continues, at times with occasional periods of slight improvement, and may thus last for three or four days until either death or recovery terminates the case.

In the comatose form of malarial fever the temperature-curve conforms to no particular type. The face is usually deeply congested, or may be pale if the pernicious symptoms occur in a person suffering from the anæmia incident to previous malarial infections. The pupils may be dilated or contracted and usually react to light; occasionally they are unequal. The pulse may show increased frequency, or may be slow, and is usually of high tension, although it may be weak and compressible, especially toward the end of the paroxysm. The respiration may be increased or decreased in frequency and stertorous, and is frequently irregular, conforming to the Cheyne-Stokes type. The skin is hot and dry, and toward the end of the paroxysm may be bathed in profuse perspiration. Occasionally petechiæ are observed, and slight jaundice is not uncommon. Certain muscles may be the seat of local spasms, as evidenced by the occurrence of trismus or deviation of the eyeballs. Involuntary evacuation of fæces and urine occurs, although urinary retention

is frequent. With the decline of the fever, coma, with the associated symptoms, disappears, and recovery may result from what is apparently the most profound infection. A second paroxysm rapidly follows the first unless energetic treatment be instituted, and this generally proves fatal. In other cases of this type of pernicious malarial fever delirium of a wild maniacal character may occur, and hallucinations and delusions are not infrequently seen. In still other cases convulsions of a tetanic character (*perniciosa comatosa tetanica*) are to be observed, and paralyses, hemiplegic or localized, are not uncommon.

ALGID FORM.—Usually after several preceding paroxysms lacking indications of anything extraordinary, the symptoms of the algid type set in. These do not occur during the cold stage, but usually immediately afterward, during the period of fever. At that time the patient passes into a condition of profound collapse. Arterial tension becomes at once lowered and the pulse is very compressible or, later, imperceptible. The eyes are sunken, the pupils dilated, the countenance drawn, assuming the Hippocratic expression. The mind remains clear, the lips are cyanosed, the tongue dry and cold; the surface of the skin is extremely cold and covered with a cold sweat; the rectal temperature is elevated. The patient complains of extreme prostration and of a distressing sense of internal heat, but does not appear to notice the coldness of the surface of the body; he is extremely apathetic and apparently unaware of, or indifferent to, the danger that threatens him. The abdomen becomes retracted, and by palpation the enlarged spleen may usually be detected; the heart-sounds are weak and feeble to the point of being inaudible. The symptoms are not dissimilar to those charac-

terizing Asiatic cholera, and in a few hours death may terminate the case.

SYNCPAL FORM.—In this form the chief symptom is the occurrence of attacks of syncope. The patient cannot make the slightest exertion, even turning from one side to the other, or merely lifting the hand, without at once passing off into a condition of syncope. Extreme weakness is complained of, the pulse is small, readily compressible, and accelerated. Should recovery from the first paroxysm take place, and treatment fail to prevent the onset of the second, death is then almost certain to occur. This form is closely related to the algid form.

SUDORIFEROUS FORM.—This type also belongs to the algid group of pernicious fevers, profuse and excessive sweating occurring during the last stage of the paroxysm; in many instances, however, the sweating occurs shortly after the beginning of the febrile stage, producing the impression that the paroxysm is to be shortened in duration. The contrary, however, is the case, as in this type the paroxysm is usually greatly prolonged. With the onset of excessive sweating the patient rapidly passes into a state of collapse, with coldness of the surface and feeble, compressible pulse. This condition becomes progressively worse and terminates fatally unless relieved.

CARDIALGIC AND GASTRALGIC FORM.—This form is characterized by severe epigastric pains occurring during the paroxysm, usually commencing in the febrile stage and disappearing with its termination. The pain is sometimes reflected to the vertebral column and is frequently associated with vomiting, hæmatemesis, a sense of choking, and hiccough. Intestinal symptoms may occur, but not invariably. The patient very shortly passes into a condition of

collapse, with weak pulse, coldness of the surface, cyanosis, and symptoms similar to those occurring in the algid form.

CHOLERIFORM TYPE.—The principal symptoms of this form are vomiting, profuse diarrhœa, and fever. At first the stools may be fæcal in character, but soon become serous, flecked with blood, and contain shreds of cast-off mucous membrane. Severe abdominal pains and cramps in the extremities are common; the surface becomes cold and moist, the pulse thread-like, and the extremities and face cyanosed; the clinical picture closely simulates the algid stage of Asiatic cholera. These symptoms have their basis in the localization of the parasites in the gastro-intestinal tract, the blood-vessels in the mucous membrane of which are found to be so choked with parasites that actual thrombosis may be produced, resulting in necrosis and ulceration. This form is one of the most commonly met with types of pernicious fever in the malarious regions of tropical and subtropical climates.

BILIOUS FORM.—The fever in this form is usually of malignant tertian type, although at the beginning several well-defined quotidian or ordinary tertian paroxysms may occur. In this event, however, the fever soon becomes remittent or subcontinuous. The onset is frequently unmarked by a chill, and the sweating is often absent and insignificant. The vomiting of a large amount of bile-stained material is one of the chief symptoms, and is often uncontrollable. The stools are often deeply bile-stained, but may be serous and at times are bloody. Epigastric pain and, later in the case, hiccough are common. Jaundice is one of the most frequent as well as important symptoms; profound disturbance of the nervous system—as evidenced by delirium, stupor, coma,

and ataxic phenomena—is frequently observed. Epistaxis and hæmatemesis also occur. The urine is deeply discolored with bile and, owing to the profuse vomiting and diarrhœa, is usually scanty. Uninfluenced by treatment, the case may continue for a week or ten days, and in spite of the most active treatment may terminate fatally in one or two days.

HÆMORRHAGIC FORM.—Although of infrequent occurrence, a few of these cases have been reported. They are characterized by extensive hæmorrhages into the skin, epistaxis, profuse bleeding from the gums, or hæmoptysis.

PNEUMONIC FORM.—It is probable that in this form there is a distinct localization of the parasites in the capillaries of the lungs. The onset is usually characterized by a marked chill, followed by a rapidly-rising temperature; severe pain may be experienced and referred to a particular part of the thorax. Marked dyspnœa, cyanosis, and cough accompanied with scanty expectoration, consisting at times of blood-streaked mucus, are striking phenomena. Physical examination results in no signs of a local lesion: simply diffused, fine bronchial râles unassociated with bronchial breathing.

There is no such thing as a malarial intermittent pneumonia nor a remittent pneumonic fever, nor a pernicious pneumonic fever. Laveran (*Amer. Jour. Med. Sci.*, Feb., '98).

Malarial Hæmaturia; Febris Biliaris; Hæmoglobinuria; Black-water Fever.—This form of pernicious malarial fever occurs especially on the east and west coasts of Africa, and particularly in Madagascar. In Europe it is of uncommon occurrence except in Greece, where it is frequently seen; isolated instances of it are also observed in Italy and the neighboring islands. It would appear from

the mass of evidence that the disease occurs only in those persons who have resided in highly-malarious regions for a considerable period of time and who have experienced previous attacks of malaria. Mannaberg is of the opinion that it rarely occurs during the first six months of residence in a malarious district. It would thus appear that by repeated infection with malaria an individual predisposition is produced to this particular form of the disease, although just what the conditions are creating this predisposition is not satisfactorily explained. It is claimed by some that anæmia is the chief causal factor. It would appear, however, that from some toxic substance present in the circulation, possibly produced by the parasite itself (Bacelli), such destruction of red blood-corpuscles ensues that the hæmoglobin is set free in the blood-serum in such enormous quantities that the liver cannot dispose of it, and hæmoglobinuria results.

The blood shows the presence of the æstivo-autumnal parasite as the exciting cause. The infrequency with which the affection is observed in temperate climates has led to the belief that the conditions appertaining to a tropical climate are necessary for its development. Anything which lowers the vitality of the individual, such as alcoholism, may constitute an important predisposing factor. Syphilis is held to possess a particular influence, owing to the analogy between paroxysmal hæmaturia and malarial hæmaturia. Physical fatigue and mental emotions are supposed to exert a certain influence. Changing from one locality to another in malarious regions is at times followed by an attack of the disease. An important rôle has been assigned by many to quinine in producing the hæmoglobinuric paroxysm.

[That this drug may have an unfavorable influence has been the subject of investigation of many observers, and it is thought by Plehn (*Deutsch. Med. Hist.*, Nos. 25 to 28, '95) that its administration is often the determining cause of hæmoglobinuria; he further demonstrates that his cases of hæmoglobinuria treated with quinine did not pursue such a favorable course as those treated with other measures. It is asserted by Tomaselli (Mannaberg, *Nothnagel's Spec. Path. u. Therap.*, B. 2, T. 2, S. 215) that in Sicily he has met with no instances of malarial hæmoglobinuria in which quinine has not been taken before the occurrence of the paroxysm, while Ughetti (Mannaberg, *Nothnagel's Spec. Path. u. Therap.*, B. 2, T. 2, S. 215) goes still further and holds to the view that all such cases are in reality instances of the toxic effects of quinine, and that hæmoglobinuria bears no relation to malarial infection. The majority of observers, however, do not entertain these views. JAMES C. WILSON and THOMAS G. ASHTON.]

Six cases in which hæmoglobinuria repeatedly followed the administration of quinine. None of the patients could take the sulphate, 2 could not take cinchona in any form, 1 not the salicylate, 1 not the valerianate, 1 not the hydrobromate of quinine, without the recurrence of hæmoglobinuria. Coromilas (*Jour. de Méd.*, Jan. 25, '91).

Hæmoglobinuria of malaria attributed not to the hæmoparasite, but to its toxins. Quinine may bring it on even in moderate doses. Four classes recognized: (1) pernicious malaria with hæmoglobinuria cured by quinine; (2) mild attacks of malaria accompanied by hæmoglobinuria only when quinine is given; (3) hæmoglobinuria coming on in persons who have had malaria some time ago, and not associated with quinine; (4) hæmoglobinuria produced by small doses of quinine in persons who have had malaria previously. Quinine should be continued in spite of the hæmoglobinuria, if the malarial attack require it. Persulphate of iron and inhalations of oxygen also recommended. Baccelli (*Policlin.*, Jan. 15, '97).

Black-water fever is more closely related to yellow fever than to malaria.

The melanuria occurs only after the administration of large doses of quinine; and is not a symptom of the disease, but a result of the quinine therapy. Below (*Med. Rec.*, Aug. 7, '97).

Acute hæmorrhagic nephritis directly dependent on malaria, where the blood has been examined with positive findings, has been noted by a number of authors, and there is no doubt that it occurs, although the condition has been attributed to the effects of quinine given for its therapeutic effects in very large doses. But well-authenticated cases are reported where no quinine had been given when the condition was first discovered.

Hæmorrhagic nephritis is the possibility of a bacterial infection's being combined with the malarial. Rupert Norton (*Amer. Jour. Med. Sci.*, Feb., '98).

The recently expressed opinion of Professor Koch that hæmoglobinuria (black-water fever) is only another name for quinine poisoning is one calculated to do much harm. Out of 9 cases of black-water fever personally treated, 2 were fatal; in both the administration of quinine was neglected until too late. All the cases which recovered were treated with heroic doses (30 grains in twenty-four hours), and the attack lasted four days, the hæmoglobinuria subsiding gradually. In the other cases in which much larger doses were administered (60 to 120 grain in twenty-four hours) the hæmoglobinuria only lasted from twenty-four to thirty-six hours, and stopped quite suddenly. R. U. Moffat (*Brit. Med. Jour.*, No. 1969, Sept. 24, '98).

Series of 15 cases of black-water fever, in each of which the hæmoglobinuria followed, more or less immediately, the administration of quinine. He believes that the statement of Koch, that black-water fever is due to the administration of quinine, is true. So extensive and unregulated use of quinine as in the tropics never occurs in more temperate countries, and, therefore, we have no idea how, if at all, the prolonged administration of the drug influences the composition of the blood. In the second place, the blood-corpuscles that are destroyed in black-water fever are not

healthy, but have been severely damaged by the preceding or still continuing malaria. Koch has in no wise altered his views, and he is still of the opinion that, in the majority of cases, black-water fever is the result of quinine poisoning in malarial patients. F. K. Kleine (Brit. Med. Jour., Sept. 14, 1901).

The part played by quinine in black-water fever is obscure. Whether it acts as a direct irritant on the kidneys or on the blood itself is not clear. Quinine acts differently in the same individual in different malarial attacks. Sometimes it apparently produces hæmoglobinuria; then, in a subsequent attack, it has no such action (Marchiafava). The whole question of black-water fever needs much more investigation. At present we can only theorize as to its causation. The relation between hæmoglobinuric fever and the malarial fevers is not clear. Quinine during a hæmoglobinuric paroxysm appears to be distinctly harmful. J. C. Curry (Jour. Amer. Med. Assoc., May 3, 1902).

As previously stated, malarial hæmoglobinuria usually occurs in those who have had repeated attacks of malaria, becoming evident during a relapse. Should it occur in a primary infection, which is rare, it is not commonly the initial symptom, but is usually preceded by a number of paroxysms. Fever, hæmoglobinuria, and jaundice are the principal clinical manifestations.

The fever may vary greatly in different cases; the type may be intermittent, remittent, or continuous, and the general statement may be made that, the less the tendency is to the occurrence of intermissions or remissions, the more severe is the paroxysm. Unlike most forms of æstivo-autumnal fever, the onset of the paroxysm is almost always abrupt and is accompanied with a severe rigor. Profuse vomiting, intense body-pains, and pains in the head and extremities soon follow, the vomitus being dark and deeply stained with bile. In many in-

stances constipation occurs, but in the graver forms there is a tendency to profuse diarrhœa, the dejections being dark and bile-stained. The pulse is rapid and at first of increased tension, while later it becomes weak and compressible. The conjunctivæ are suffused, the face is flushed and expressive of the great anxiety the patient is laboring under.

The *urine* varies greatly in specific gravity and is usually faintly acid in reaction. In the early stage of the paroxysm in which hæmoglobinuria occurs the urine is light red in color. This soon deepens, however, until during the height of the paroxysm it becomes dark brown or almost black. Owing to the presence of bile, this color is slightly tinged with green and the urine is frothy upon shaking. It is usually perfectly clear above the dark-brown sediment that is deposited upon standing. This sediment is made up of masses of pigment, mucus, epithelium from the bladder and kidneys, hyaline and granular epithelial casts, and, unless the case be one of true hæmoglobinuria, numerous red blood-corpuscles. The amount of urine, although generally reduced, varies greatly, and in severe cases may be almost entirely suppressed. It, of course, shows the presence of albumin in large amounts, and in some instances the presence of biliary pigments may be detected. Inflammation of the kidneys almost always accompanies, or follows, malarial hæmoglobinuria, and in some instances proves rapidly fatal with symptoms of uræmia. In mild cases, however, it is slight and soon passes away.

In all varieties of malaria the toxicity of the urine is increased from the beginning to the end of the attack, but not with any regularity of progression. The more toxic the urine, the more abundant the phosphates present and the deeper

the color. Pensuti (Münch. med. Woch., Nov. 29, '92).

Conclusions drawn from study of 758 cases of malarial fever:—

1. Albuminuria is a frequent occurrence in the malarial fevers of Baltimore, occurring in 46.4 per cent. of our cases.

2. It is considerably more frequent in æstivo-autumnal infections than in other forms, occurring in 58.3 per cent. of these instances against 38.6 per cent. in the regularly intermittent fevers.

3. Acute nephritis is not an unusual complication of malarial fever, having occurred in 2.7 per cent. of the cases treated in the wards of the Johns Hopkins Hospital, and in between 1 and 2 per cent. of all cases seen at the institution.

4. The frequency of acute nephritis in æstivo-autumnal fever is much greater than in the regularly intermittent fevers, having been observed in 4.7 per cent. of the cases treated in our wards and in 2.3 per cent. of all the cases seen.

5. The frequency of albuminuria and nephritis in malarial fever, while somewhat below that observed in the more severe acute infections, such as typhoid fever, scarlet fever, and diphtheria, is yet considerable.

6. There is reason to believe that malarial infection, especially in the more tropical countries, may play an appreciable part in the etiology of chronic renal disease. William Sydney Thayer (Amer. Jour. Med. Sci., Dec., '98).

Jaundice is a constant symptom, and sometimes occurs as a prodromal manifestation; ordinarily, however, it first occurs coincidently with the hæmoglobinuric paroxysm, and becomes most intense during the febrile stage; it usually continues for several days following the termination of the paroxysm.

In the milder cases decided remissions, or even intermissions, of the paroxysms occur, and with the fall in temperature the urine clears up and the jaundice lessens in intensity. From this point recovery may take place, but usually repeated paroxysms follow. In the severe

forms the temperature remains continuous, and the intensity of the symptoms described becomes aggravated until a condition of collapse supervenes. Delirium is not usual and the patient is anxious and apprehensive. At times, with almost complete suppression, or the secretion of a very small amount of intensely-bloody urine, death may occur within several days. In these cases algid symptoms may be present; the pulse small, rapid, and weak; the surface of the body cold and bathed in cold perspiration; stupor, coma, or convulsions. In other cases profuse nosebleed, hæmorrhages from the mouth and bowels, constant hiccough, involuntary evacuation of fæces, and delirium close the scene.

Relapses.—The occurrence of fevers after long intervals of apyrexia and apparent health has long been recognized. Since the discovery of the malarial parasite many observers have endeavored to associate the occurrence of these cases with infection by a parasite whose cycle of development required a much longer period for its completion than that required by the parasites already described. It has already been pointed out that a malarial paroxysm does not follow the sporulation of a group of parasites until the group has attained a sufficient size to produce toxic effects at the time of sporulation. It has also been stated, in the brief allusion to the process of phagocytosis, that only a certain number of the young spores enter fresh corpuscles and complete again the cycle of development, and that a considerable number of them following sporulation are destroyed by some constituent of the blood-plasma and by the action of the phagocytes. In this manner a sufficient number of young parasites may be destroyed to prevent the immediate recurrence of the paroxysm, and it is only when, from

the parasites that have escaped destruction, a sufficiently large group has been generated to produce symptoms that a paroxysm again takes place. Precisely the same effect is produced when malaria is imperfectly treated with quinine, as, for instance, the administration of a single dose of the drug following a paroxysm. A certain number of spores are destroyed sufficient to prevent the recurrence of the paroxysm at the usual time; the spores that escape infect fresh corpuscles, complete their cycles of existence, until after successive generations the group has become sufficiently large to produce a paroxysm. It may thus be seen that the intervals marking the occurrence of the paroxysms are prolonged and irregular, and may be from five to twelve days, or even longer. Fevers with long intervals may result in tertian and quartan infections, as well as in æstivo-autumnal infection, and they are to be regarded as relapses, occurring in the manner just described, and not as due to a particular variety of parasites whose cycle of development requires an extraordinarily long period.

The Blood.—The changes in the blood, aside from the presence of the parasites, are largely dependent upon the destruction of red blood-cells and the setting free of hæmoglobin. In all forms of malaria a reduction in the number of red blood-corpuscles and in the percentage of hæmoglobin follows each paroxysm. In æstivo-autumnal infections this reduction is more decided than in the regularly intermittent forms, and the tendency to restitution to the normal between the paroxysms is not so marked. In tertian and quartan fevers the return to the normal number is very rapid.

The number of white blood-corpuscles is always less than normal, and the reduction is always greatest just after a

paroxysm. A differential count shows a decided relative decrease in the percentage of polymorphonuclear neutrophiles, with a relative increase in the percentage of large mononuclear leucocytes. In certain instances of pernicious malaria a decided leucocytosis has been observed, doubtless due, at least in some of these cases, to secondary infections. In any event, the occurrence is of unfavorable significance.

General Etiology.

CLIMATIC CONDITIONS.—The influence of heat upon the development of malaria is clearly shown in the geographical distribution of the disease. It not only prevails to a much greater extent in tropical and subtropical climates, but in these regions it is encountered in its most intense forms; and, furthermore, as the temperate and colder climates are approached, the prevalence and intensity of the affection progressively decline; so that in those latitudes where the mean summer temperature does not exceed 15-16° C. malaria ceases to exist.

SEASON.—From these remarks it may readily be seen that the effect of season upon the prevalence of malaria exists in its fullest extent only in those regions characterized by marked seasonal differences in the temperature. In the tropics the disease prevails throughout the year, although its greatest virulence is to be observed during summer and autumn, while in temperate climates it is of uncommon occurrence in winter and spring. In tropical and subtropical climates, however, the maximum prevalence is attained in July, August, and September, when to the greatest elevation of temperature there is added the maximum amount of atmospheric moisture. It must be borne in mind, also, that not only the number of cases, but also their severity, is in direct relation to the tem-

perature elevation. Thus, in temperate climates the mildest types are to be observed in the spring, and are then due to tertian and quartan infections, usually with a single group. With the approach of summer, infection with more than one group of the tertian parasite becomes of more common occurrence, and with the beginning of July the severer forms of fever due to æstivo-autumnal infection make their appearance, reaching their height during August, September, and October.

The recurrence of malaria in the winter and spring has given rise to the interesting question whether these cases are instances of fresh infection or whether they are relapses from infections received during the preceding malarial period? This question has as yet received no definite solution, although the experience of most observers tends to support the view that, while cases of primary infection occur in the spring, such cases are, of course, of more common occurrence during the more active malarial periods. Nevertheless, it is the experience of most of those entitled to an opinion that those cases of malaria occurring in winter are to be regarded as relapses from infection received during the preceding summer. It is further to be observed that malaria prevails to a greater extent, and with more severe manifestations, during warm than during cold summers, and especially during warm summers accompanied by a high degree of atmospheric moisture. Heat alone, therefore, is not all-sufficient for the development of malaria, and only becomes of etiological importance when associated with other conditions presently to be discussed. The truth of this statement is exemplified in numerous communities in tropical climates where these combined conditions do not exist.

MOISTURE.—Much stress is to be laid

upon the influence of moisture upon the development of malaria, and this is true equally of atmospheric moisture and telluric moisture. As above stated, in malarious regions the number of cases is usually materially greater during a summer attended by a heavy rain-fall than during a dry summer. In tropical countries the first notable increase in the number of cases occurs when the dry season is first terminated by the autumn rains, but when the rainy season has continued a sufficient length of time to more or less completely inundate the surface of the ground a decrease in the prevalence of the disease takes place. When, however, upon the termination of the wet season the sun regains its full vigor, the evaporation of the moisture from the ground that ensues causes the number of cases again to become largely augmented. (Mannaberg.)

THE WINDS.—Although it has been asserted that the winds play a certain part in the spread of the infection, they cannot be regarded as having any direct bearing upon the development of malaria. It has been long recognized that a growth of trees along the border of a malarious district appears to check and limit the distribution of the infection by arresting the miasmatic-laden winds. This limitation, however, probably depends upon other conditions presently to be described, and the winds cannot be regarded as a very important factor in the dissemination of the infection.

TELLURIC CONDITIONS.—That the condition of the soil has some close association with the development of malaria there is much confirmatory evidence. It is a well-known fact that sailors and others on board ships anchored off shore in even highly malarious regions escape infection, while those from the same ships who land and remain on shore but

for a short period, contract the disease. This association between the soil and the malarial infection is strikingly illustrated in those whose occupations call for its disturbance. Thus, in malarious regions the infection is rife among those engaged in building railroads, canals, and kindred enterprises, and is usually then to be met with in its most intense and pernicious forms.

In general, malaria particularly prevails in low, marshy localities which are rich in decaying vegetable matters and in which the drainage is ineffective. Salt marshes are usually non-malarious, although marshes that are alternately fresh and salt as they may be subjected to inundation from neighboring fresh-water streams and from salt water at the flood of the tide are to be regarded as highly noxious. Malaria, therefore, is less likely to prevail when the geological conditions of the soil favor the rapid drainage of the moisture, or its prompt absorption. If, however, the conditions are such that the moisture is not rapidly absorbed by the soil, but is taken up by evaporation into the atmosphere, the disease prevails. In this connection a subsoil impervious to moisture is to be regarded as particularly favorable to the development of the infection.

Disturbance of the soil, even in districts where the disease has not previously prevailed, is at times followed by an epidemic of malaria. This association is, of course, greatly accentuated in regions already malarious; and, as already pointed out, the excavation of the soil in malarious regions for such purposes as railway and canal construction is apt to be attended by an outbreak of the severe forms of the disease. This is particularly liable to occur when such excavations call for the disturbance of rank vegetation or vegetable *detritus*.

From what has already been said, the effect of drainage upon a malarious region may readily be surmised. The instances in which the institution of a proper drainage has been followed by the entire disappearance of the disease from extensive regions in which it previously thrived are now too numerous to call for particular mention. In rather a direct ratio to the establishment of drainage of marshy regions and their subsequent cultivation a corresponding improvement takes place in the healthfulness of malarious districts. The planting of trees has been observed to be particularly effective in accomplishing this result, but it is not probable that one variety possesses more value in this respect than another. The advantage of a tree-growth, therefore, is to be ascribed more to the better drainage of the soil which it accomplishes than to any specific power possessed by certain varieties. The latter view was at one time quite largely entertained, and the marked improvement in the sanitary conditions following the planting of the *Eucalyptus globulus* in certain malarious regions afforded a basis for its belief. The abandonment of regions formerly subjected to a high degree of cultivation has been followed by malaria, often of a virulent type, although previously the disease was unknown. This fact is strikingly illustrated by the Roman Campagna, where, during the period of its cultivation, malaria was practically unknown. From the time of its abandonment, however, to within recent years, and even at the present day in certain sections, malaria prevails there with extreme intensity.

ALTITUDE influences the development of malaria to the extent that with increasing elevations a corresponding decrease in the prevalence and intensity of the infection occurs, and, even in mala-

rious districts, those residing in the upper stories of dwellings are less liable to the disease than those whose living-quarters are nearer the ground. While increasing elevation has the effect mentioned, it must be borne in mind that malaria may prevail wherever heat, moisture, and decaying vegetable *detritus* are to be found associated, and the increase in altitude simply diminishes the chances for the association of these conditions.

GEOGRAPHICALLY malaria is a widespread disease. In America the region of its prevalence is gradually becoming more and more restricted, and in many sections, notably the New England States and upper Atlantic sea-coast, where formerly it prevailed extensively, it has now ceased to occur except in the mildest forms. In the Southern States, particularly along the gulf and the Mississippi River, the disease is almost constantly present, while it is still to be met with in certain regions about the Great Lakes. In Europe, although the disease is still to be found in parts of France, Germany, and even England, its chief seats of activity are to be found in certain regions of Italy and in Southern Russia. Tropical and subtropical regions, however, where the telluric and other conditions already mentioned as favorable to its genesis exist, are the parts of the world where malaria is to be particularly encountered and where it more or less constantly prevails.

The same type of malarial fevers found in the Philippines as are found in other tropical countries, namely: the æstivo-autumnal, the tertian, and the quartan. There was this important difference from other tropical countries, however, which explains in part the comparative mildness of the Philippine malarial fevers: The predominating type of malarial fevers reported in

other tropical countries is the æstivo-autumnal.

In the Philippines a much larger percentage of the malarial fevers appears to be due to the tertian parasites than has been reported by investigation in the other tropical countries. In 223 cases of malarial fever in which the parasites were found in the blood, in cases observed in the First Reserve Hospital, Manila, P. I., there occurred the æstivo-autumnal parasites in 166, the tertian in 53, the quartan in 1, and the tertian and æstivo-autumnal combined in 3.

Taking the pure infections (220 cases) alone, the tertian parasite occurred in 53 out of 220 or 24 per cent., the quartan in less than one-half of 1 per cent., and the æstivo-autumnal in 75 per cent. J. J. Curry (Boston Med. and Surg. Jour., May 9, 1901).

AGE has no direct influence upon the susceptibility to malaria. Those in the active periods of life contract the disease more frequently because they are more exposed to the predisposing causes, while the very young and the aged, only because they are less likely to be exposed, enjoy an apparent immunity. Exceptions to this statement will presently be noted.

Case of congenital malaria when child was 10 weeks old. Physical examination showed the patient to be much emaciated, pale and weak. Convulsions occurred daily since birth. When child was 11 weeks old, blood was examined and plasmodium *malariae* found in abundance. The child was given 1 grain of quinine by the rectum in enema twice daily, and the convulsions ceased from this time, but muscular rigidity, sleeplessness, colic, constipation, and restlessness persisted.

Since patient did not improve nor gain in weight after a month's treatment with quinine, child was taken to a non-malarial place, where it began to improve immediately. The plasmodia were probably conveyed directly by means of the foetal circulation, although there is a possibility of infection by the mother's milk.

Kenelm Winslow (Boston Med. and Surg. Jour., May 2, '97).

Fatal case of pernicious malarial poisoning in a newborn infant. On morning of the day following delivery, mother had a chill. At the same time the child became comatose and cyanotic, cold, its face blue and pinched, and finger-nails blue, with rectal temperature 103.5°, and had rapid respiration. Victor Cadwell (Amer. Medico-Surg. Bull., July 25, '97).

Enlargement of the spleen in children is of little diagnostic value without a corroborative examination of the blood. Quite severe cases of tertian malaria occur in children in whom there is no enlargement of the spleen, and many cases in which the spleen is enlarged are not malarial. Henry Koplik (Med. Record, Feb. 5, '98).

Best examined the blood of 320 children under fifteen years of age, all presumably healthy, who lived in the town of Lagos. Fifty per cent. of these children were found to have malarial parasites or pigmented leucocytes in their blood. McGregor (Brit. Med. Jour., Dec. 20, 1902).

RACE appears to exercise a certain influence upon susceptibility to the disease; thus, the native inhabitants of malarious regions appear to possess a relative immunity. In America the negro possesses this insusceptibility to a considerable degree, and it has been estimated by Thayer, as the result of his observations in Baltimore, that this race possesses only about one-third the susceptibility that the white possesses.

[On the other hand, Frederick Smith (Brit. Med. Jour., No. 1981, Dec. 17, '98), from a study of immunity as illustrated by the incidence of the disease on various races in Sierra Leone, concludes that, while there is such a thing as immunity, it is only of a relative kind, and that such immunity as exists is acquired. From this stand-point, he believes that the negro possesses no special immunity. JAMES C. WILSON and THOMAS G. ASHTON.]

OCCUPATION is of considerable importance in its bearing upon susceptibility.

Those whose pursuits entail disturbance of the soil in malarious districts, such as farmers, railway-laborers, and the like are particularly liable. Also those who are obliged to approach the swampy banks of rivers and inlets, such as fishermen, are rendered susceptible. Soldiers, probably because they sleep upon, or in close proximity to, the ground are very susceptible, as the malarial infection, as is well known, tends to cling to the soil.

Pathological Anatomy.

ACUTE MALARIAL INFECTIONS.—Our knowledge of the pathological changes in acute malarial infections is necessarily largely derived from a study of the condition of the internal organs as found in the grave forms of æstivo-autumnal infection, as cases of quartan and tertian infections rarely reach the post-mortem table.

Melanosis due to the accumulation of pigment derived from the hæmoglobin by the action of the parasites constitutes one of the most significant anatomical changes. The distribution of pigment in the various organs imparts to them a peculiar slaty-gray color, which is characteristic. Neither the malarial pigment nor the malarial parasite is distributed in the various organs with any degree of regularity. Not only is this irregularity manifested in different cases of infection with the same variety of parasite, but it has already been pointed out that in infection with the quartan parasite the peripheral blood appears to contain the organism in greatest number, while in tertian infection to a certain extent and in æstivo-autumnal infection to an almost exclusive extent the parasites are to be found in the blood-vessels of the internal organs. It thus becomes evident, not only that melanosis varies in different cases, but that pathological changes dependent upon the presence of the para-

sites are also irregularly distributed. It is also to be remarked that this varying distribution of the parasites in all probability has an important bearing upon the clinical manifestations.

Pigment is found to accumulate to a greater extent in the capillaries than in the blood-vessels of larger calibre, and the same is true of the pigment-laden parasites. Especially is the accumulation marked where the blood-current is retarded by the lessening of the calibre of the blood-vessel at the point where the artery merges into the capillary. Melanosis, therefore, as well as parasitic congestion, may be looked for in the capillaries of the cerebral convolutions, the dura mater, the pulmonary alveoli, the intestinal villi, and the glomeruli of the kidneys. Ordinarily, however, the blood-vessels of the spleen, liver, and brain show the greatest accumulations.

Characteristic effects due to long-continued malarial poisoning are mainly observed only in the liver, spleen, and kidneys. These effects are of two kinds: pigmentary and cirrhotic. In the former black and yellow pigment is found distributed through the organ, while in the latter the organ presents a thickening of its stroma and a growth of new connective tissue; and in each organ the pigmentary changes are mainly found in the less chronic, and the cirrhotic in the more chronic, cases. L. F. Childe (Indian Medico-Chir. Review, Feb., '96).

The Spleen.—The spleen is always enlarged, although in varying degree. Its consistency is diminished, often to such an extent that the attempt to remove it results in rupture of its tense capsule and the escape of its diffuent pulp. The pulp is frequently the seat of a melanosis varying in intensity from a dark-brown to almost a deep-black discoloration; it is sometimes evenly distributed over the entire organ and sometimes irregularly

deposited. The cut surface is usually a dark-gray-brown or slaty color, and the unpigmented Malpighian corpuscles stand out prominently. The capsule is thin and easily torn. Microscopically, dilatation of the venous sinuses, often marked, is to be observed. The pulp contains enormous numbers of red blood-corpuscles, which in greater part are found to be infected with parasites in all stages of development, while occasionally free parasites are to be found.

The presence of large numbers of phagocytes, particularly the large cells known as macrophages previously referred to, is a marked characteristic. While leucocytic phagocytes occur, the predominating variety is this large cell, which exists in very considerable numbers. The protoplasm of these cells is seen to contain pigment-granules, in clumps or rods, as well as parasites free or included within their corpuscular hosts. The parasites, which are in various stages of development, often complete their cycle of existence while thus contained within the macrophages, and the latter not infrequently show evidences of necrosis; a probable result of the destructive effect of the parasite. The splenic veins, while containing phagocytes laden with pigment, contain comparatively few infected blood-corpuscles; with the latter, however, the capillaries are usually filled.

Capillary thrombosis may be the cause of necrotic foci scattered throughout the structure of the spleen. The spleen in all cases does not present marked melanosis, and in many cases is relatively free from both pigment and parasites.

The Liver.—In most cases the liver is somewhat enlarged and, from the large number of parasites and pigment contained within its capillaries, is of a dark-slate-colored hue, often almost black.

Microscopically, the capillaries of the hepatic artery, of the portal vein, and of the hepatic vein are found to be crowded with pigmented parasites. In the branches of the portal vein may be seen the very largest macrophages, which have originated in the spleen and which, on account of their large size, obstruct the calibre of the vessels. The hepatic cells are swelled and often contain pigment, and at times fragments of red blood-corpuscles may be observed within them. The capillary endothelial cells not infrequently show the presence of pigment as an evidence of their phagocytic action, and as they are often considerably swelled the capillary lumen becomes correspondingly limited. In the periportal connective tissue a small-cell proliferation is not infrequently to be observed, which may be the starting-point from which occurs the hepatic cirrhosis at times noted as a sequel to malarial infection (Mannaberg).

[Barker (Johns Hopkins Hosp. Reports, vol. v, '95) describes the occurrence of scattered foci of local necrosis of the liver-tissue, depending, probably, upon capillary thrombosis brought about by various forms of leucocytes. They are very similar, however, to analogous changes occurring in other acute infectious diseases, in which their occurrence is ascribed to the action of circulating toxins. JAMES C. WILSON and THOMAS G. ASHTON.]

The liver in most cases shows a varying degree of hyperæmia, which accounts, to a certain extent, for the enlargement of this organ. To the hyperæmia, also, as well as to the large amount of pigment deposited in the organ, is to be ascribed its increase in weight.

The Kidneys.—The macroscopical changes so apparent in the liver and spleen are not often to be observed in the kidneys. Nevertheless, at times, points of pigmentation can be detected

within the cortex or along the course of the vessels in the pyramids. Microscopically, pigmentation to a considerable extent may be observed, especially in the glomeruli, the pigment being contained within large leucocytes, which may produce a narrowing of the calibre of the vessels; at times the endothelium of the glomeruli may be pigmented. Degeneration and desquamation of the epithelium of the capsules of Bowman constitute one of the most serious lesions, while in the tubules may be found, here and there, areas of necrotic epithelium.

In hæmoglobinuric, or black-water, fever the changes in the kidneys are most marked. They are usually increased in size, of somewhat lessened consistence, and of varying color, being frequently pale and anæmic in appearance; less frequently they are a darkened color. Upon the surface of the organ, especially when it is pale, are to be observed scattered brownish spots due to pigment-deposits which crowd the epithelium and lumina of the uriniferous tubules. Kiener and Kelsch (Arch. de Phys. Norm. et Path., '92) have also described the appearance of intratubular hæmorrhages within the pyramids, as a result of which this portion of the renal structure assumes a deep-red color. Microscopically the renal epithelium is found to contain pigment; and pigment-rodlets, or fine-yellow granules, or dark, amorphous masses, are observed to fill the lumina of the uriniferous tubules. Usually some of the tubes are filled with blood-corpuscles, and sometimes the evidences of a beginning nephritis are found.

Malarial fever should be given a prominent position in the etiology of chronic as well as of acute nephritis. In all cases of malarial fever the urine should be closely watched. A blood-examination should be made in all cases of nephritis occurring in those who have visited or lived in a ma-

larial district as it often happens that the severe grade of nephritis resulting may mask entirely the clinical picture of malarial fever. Larned (Johns Hopkins Hosp. Bull., July, '99).

The Gastro-Intestinal Tract.—Except in a few instances, the gastro-intestinal tract shows but little change other than that arising from the deposit of pigment. Microscopically the capillaries of the mucous membrane may be found to contain parasites as well as phagocytic cells containing pigment in greater or less amount.

It has been shown by Bignami, however, that in certain instances the gastro-intestinal tract may constitute the point of chief localization of the infecting parasites. These cases, clinically, usually present the manifestations characteristic of the choleraic form of pernicious fever. Microscopically there may be intense injection of the mucous membrane of the stomach and intestines, with numerous punctiform hæmorrhages. The capillaries of the mucous membrane may be crowded and their lumina obstructed with parasites, which may be contained within phagocytes, or red blood-corpuscles, or may exist free. These thromboses result in necrosis of the epithelium of the mucous membrane with superficial ulceration. Barker (Johns Hopkins Hosp. Reports, vol. v, '90) reports a case in which the capillaries of the mucous membrane were so blocked with parasites contained within mononuclear macrophages that numerous small, circumscribed areas of necrosis of the mucosa resulted.

The Lungs.—In many cases areas of broncho-pneumonia or infarction are to be observed, and it is somewhat noteworthy that the areas of broncho-pneumonia do not, as a rule, show the presence of pigment. Microscopically the capillaries of the alveoli are found to be filled

with infected blood-corpuscles and macrophages.

The capillary endothelium infrequently contains pigment, although the large number of phagocytes contained within the alveolar capillaries may lead to necrosis. It is unusual to find pigment-containing leucocytes in the interior of the alveoli.

The Heart and Muscles.—The cardiac muscle is frequently pale, softened in consistence, and shows the evidences of fatty degeneration; the same changes may be observed in the general muscular system. This degeneration of the myocardium and of the voluntary muscles may in part be due to the blocking up of the capillaries with parasite-containing blood-corpuscles and cells.

Many authors believe that malaria may cause definite heart-lesions, but again there is not a single case reported which is of convincing evidence, and as negative proof against this theory Laveran and the other authorities on malaria hold the opposite view. Norton (Amer. Jour. Med. Sci., Feb., '98).

The Bone-marrow.—The bone-marrow is of brown-red color, sometimes almost black; it is soft, almost diffuent. The vessels are found to contain developing, as well as sporulating, parasites, and crescents are usually present in abundance. About the periphery of the lumina of the vessels macrophages containing pigment may be found in considerable numbers. Nucleated red blood-corpuscles, which sometimes exist in great numbers, do not contain parasites (Mannaberg).

The Brain.—Macroscopically the brain may show but slight evidence of change, and melanosis may not be present. Usually, however, a distinct localization of the infected blood-corpuscles appears to take place in the cerebral capillaries, and then melanotic discoloration, especially

of the gray matter, may be observed. Marked discoloration of the cortex may thus occur, with deep injection of the blood-vessels and, not infrequently, numerous punctiform hæmorrhages. These changes are to be particularly observed in instances of pernicious fever of the comatose form, and in such cases the microscopical findings are remarkable. Parasites in all stages of development, although one stage usually predominates, crowd the cerebral capillaries until, in places, complete obstruction or thrombosis of their lumina takes place. These parasites, although commonly seen to be within red blood-corpuscles, may be free, or contained, together with pigment or blood-corpuscles, within phagocytes. The latter may be macrophages, leucocytes, or may be derived from the endothelium of the capillaries.

CHRONIC MALARIAL INFECTIONS AND CHRONIC MALARIAL CACHEXIA.—Numerous pathological changes are to be observed in the organs of those who have been the subjects of long-continued infection with malaria; the most noteworthy of these changes occur in the spleen, liver, and bone-marrow.

The Spleen.—Notable enlargement of the spleen always occurs, and thickening of its capsule is usually to be found. This thickening, as a rule, is not evenly distributed, but is apt to show as scattered islets. Not infrequently these islets, or plaques, are cartilaginous in character, and occasionally ossification of the capsule takes place. The consistence of the enlarged spleen is much increased and its border is usually well defined. Its color is usually red, but not infrequently it has a grayish-brown or slaty color. The cut surface shows marked prominence of the trabeculæ, which corresponds to the degree of increase of the connective tissue and thickening of the sheaths of the

vessels. The veins are dilated to such an extent as to simulate angiomata, and the Malpighian bodies are but slightly apparent.

The microscopical changes are significant. Shortly after the termination of the actual infection a cessation of the acute hyperæmia occurs and necrotic areas develop in the pulp, while some of the follicles also become necrotic and fibrous. In addition, extensive regenerative changes take place, originating largely from the follicles, which become markedly hyperplastic; hyperplasia of the elements of the pulp is also to be observed. The arrangement of the pigment becomes changed; it gathers in small clumps in the pulp and becomes concentrated in the sheaths of the vessels and the connective tissue of the septa. The macrophages, which in the acute tumor are the carriers of the pigment, disappear, probably as the result of degeneration, and the pigment in the chronic tumor becomes extracellular (Mannaberg). Subsequently the pigment disappears completely. While absorption of the areas of necrosis takes place, dilatation of the vessels and hypertrophy of the septa become more marked and the splenic pulp becomes so compressed as to entirely disappear. The final result of these changes is that the function of the spleen is entirely destroyed and the recognition of its histological elements becomes impossible.

The Liver.—The liver is increased in volume and weight, at times very greatly; its surface is smooth and its consistence increased; thickening of the capsule is of frequent occurrence. The cut surface is found to vary somewhat in accordance with the duration of the infection. In general, the lobules are slightly prominent and quite distinct, while the appearance of the surface is finely granular.

The changes to be observed by microscopical examination are thus summarized by Mannaberg from the researches of Bignami. Shortly after the termination of the acute infection it will be noticed that the parasites have disappeared from the capillaries, the endovascular macrophages are no longer to be seen, and the pigment is entirely collected in the endothelium and in Kupffer's cells. A decided atrophy occurs in those parts of the liver-lobules in which necrosis has taken place and the vessels become dilated. The lobule is further freed from pigment, which is carried by the mononuclear and polymorphonuclear leucocytes to its periphery. At the same time the beginning of regenerative changes becomes apparent in the liver-cells.

The next stage is that which, in consequence of the atrophic and regenerative processes, leads, on the one hand, to the development of pseudo-angiomata and lymphatic cysts, and, on the other, to the formation of abnormally-large lobules. The pigment is carried out of the vessels by the leucocytes and deposited in the perivascular lymph-spaces, while the perilobular connective tissue becomes hyperplastic.

The final result is a large, dense liver, of a reddish color, which upon section shows the finely-granular lobules to be surrounded by trabeculae of connective tissue. The vessels are dilated and the organ is congested, while pigmentation is no longer to be seen. Kelsch and Kiener assert that a few months after the termination of the acute infection pigment is no longer to be found, and Bignami has observed that it has, in large part, disappeared in from three to four months.

The development of a true atrophic cirrhosis of the liver due to malarial infection is as yet an undecided question,

and must be, in any event, of rare occurrence. Kelsch and Kiener, however, distinguish three forms of chronic malarial hepatitis ([1] with hyperæmia; [2] with cirrhosis; [3] with adenomata) and two groups of cirrhosis ([1] insular cirrhosis with nodular hepatitis, and insular cirrhosis with diffuse parenchymatous hepatitis; [2] annular cirrhosis, with nodular or diffuse parenchymatous hepatitis).

Both Marchiafava and Bignami deny that true cirrhosis follows malaria, and make the following distinctions: In the case of malarial cirrhosis or hepatitis the increase in the connective tissue is perilobular, and surrounds the individual lobules, and the branches of the portal veins are not obliterated. In true atrophic cirrhosis the hyperplastic connective tissue surrounds a number of lobules, retracts upon them, and leads to compression of the portal vessels. The changes taking place in the liver-cells in the two conditions are also different, being, as the result of malaria, of a grave nature and primarily local, while in true atrophic cirrhosis they depend upon the newly-formed perilobular connective tissue.

The Bone-marrow. — The marrow of the long ones, particularly in the upper and lower portions, is usually red and its consistence somewhat increased. The microscopical examination reveals proliferation, more or less active, of the cellular elements of the marrow, and greatly increased vascularity. The mononuclear myelocytes, both large and small, are increased and many of them show evidences of degeneration. Nucleated red blood-cells, or normoblasts, are found in large numbers, as well as a few megaloblasts or gigantoblasts. Pigment disappears from the bone-marrow much earlier than from the other organs. In rare cases the marrow presents the same features as is

found in pernicious anæmia, showing a considerable number of gigantoblasts and megaloblasts.

The Kidneys.—No marked changes occur in the kidneys in chronic malaria. Kelsch and Kiener, however, describe two forms of kidney occasionally met with in this condition: the congested form and the atrophic form. The histological changes characterizing these conditions seem hardly called for in the scope of the present article.

Diagnosis.—The diagnosis of malarial fevers mainly depends upon the result of the examination of the blood, and the more doubtful the case, the more it resembles some other affection, the more necessary is a resort to this means of attaining a positive conclusion. To a less degree the diagnosis is established by the results of the therapeutic test: *i.e.*, the administration of quinine and the clinical manifestations.

In many cases the symptom-grouping, the regularly-recurring paroxysms, and the orderly sequence with which the various stages succeed one another may be quite sufficiently characteristic to warrant the diagnosis of malaria. This is particularly true if the case be one of single tertian, single quartan, or double quartan infection, for no disease through any considerable period of time will present such regularity in the recurrence of the febrile paroxysms. There are many affections frequently encountered, however, which offer some difficulty in differentiating from malarial fever of quotidian type whether due to double tertian or triple quartan infection.

PULMONARY TUBERCULOSIS—from its wide prevalence and the fact that it is frequently attended by daily febrile paroxysms consisting of more or less well-defined stages of chill, fever, and sweating—is probably more commonly mistaken

for malaria, in regions where the latter affection prevails, than any other disease. Only ignorance or carelessness, on the part of the physician, however, can result in confusing the two maladies. In tuberculosis the absence of splenic enlargement, the anæmia lacking the peculiar sallowness of malaria; the occurrence of the febrile paroxysm in the later hours of the afternoon instead of the forenoon, except when the inverse type of fever prevails; the result of the physical examination of the lungs, the presence of tubercle bacilli in the sputum, and the result of the blood-examination constitute a group of events which, when properly interpreted, preclude the possibility of confusion between these two diseases.

OTHER SEPTIC PROCESSES may be confused with malarial fever, such as the fever accompanying malignant endocarditis; septic processes involving the biliary passages or the genito-urinary organs, as pyelitis, pyelonephritis, or urethral fever, so called, arising from gonorrhœa or the introduction of instruments into this passage; the fever associated with malignant new growths, or empyemata in various locations. In all these instances the previous history of the case, the results of the physical examination and the examination of the blood will decide the diagnosis. Of these, of course, the most important is the blood-examination; the absence of leucocytosis, or actual reduction of the number of leucocytes, and the presence of parasites in malaria; the presence of leucocytosis and absence of parasites in the various forms of septicæmia.

The æstivo-autumnal fevers may also be confused with tuberculosis and other septic processes particularly in those instances where the intervals between the paroxysms are well marked. The same

means of differentiation are to be invoked, however, as in the case of the regularly-intermittent fevers. When by retardation and anticipation of the paroxysms, however, the intervals between them become almost or completely obliterated, æstivo-autumnal fever may so resemble typhoid fever that an examination of the blood becomes necessary to establish the diagnosis. Here the presence or absence of the parasites must alone be depended upon, as in neither disease does leucocytosis occur. Clinically the persistence of a trace of the paroxysm, the presence of jaundice, early anæmia, herpes or urticaria, and the relative infrequency of Ehrlich's diazo-reaction in the urine will aid in confirming a diagnosis of malaria.

Four undoubted instances in which the co-existence of malaria and typhoid has been actually proved by microscopical blood-examinations. These at least are all that it has been possible to find on record.

Other than irregularity of fever, and occasionally chills, there is nothing in these cases of mixed infection by which to suspect their nature, and the course of the typhoid malady is not influenced; it only proves how necessary it is in all instances of typhoid fever, especially of the irregular kinds, to make blood-examinations for malarial parasites. J. M. Da Costa (*Internat. Clinics*, vol. ii, Seventh Series).

The **PERNICIOUS FORMS OF MALARIA** are to be separated from conditions with which they are likely to be confounded chiefly by an examination of the blood. In these forms confusion may arise between the hæmorrhagic type and yellow fever, the choleric type and Asiatic cholera, the comatose type and insolation, and the hæmoglobinuric type and ordinary paroxysmal hæmoglobinuria. To the observer the examination of the blood may constitute the only positive means of reaching a definite conclusion.

Chronic malarial cachexia is to be differentiated from the grave anæmias, leucæmia, and pseudoleucæmia by the examination of the blood, or, when this fails to give positive results, by the early history of the patient and the amenability of the condition to proper remedial measures.

The administration of quinine is the therapeutic test for malaria, and is of importance if it be impossible to make a microscopical examination of the blood. Under the influence of proper doses of this drug no malarial fever will persist for more than four or five days.

Neglect of examinations of blood has led to the gravest mistakes. A patient presented herself to a surgeon, complaining of pain in the lower abdomen, pelvis, and back, with chills and fever. Upon examination a mild pelvic peritonitis was found. She was advised to have the tubes and ovaries removed, and submitted to the operation. The patient had a severe chill the next day, followed by a rise of temperature to 107°, and collapse. The blood was then examined and found teeming with malarial organisms. The patient eventually recovered, but nevertheless the operator was negligent in not excluding by systematic study of the case the possibility of malarial infection, before performing what proved to be an unnecessary mutilating operation. W. W. Russell (*Johns Hopkins Hosp. Bull.*, Nov. and Dec., '96).

Cases of malaria illustrating its various manifestations. One commenced with symptoms of catarrhal dysentery without chill or variation of temperature, the symptoms exhibiting periodic exacerbation. In another case there was severe diarrhœa, with two days' intermission and considerable malaise; in another diarrhœa of three weeks' duration. A case of ulcerative stomatitis was cured on three occasions with quinine. Other cases presented urticaria, conjunctivitis, leg-ulcers, periodic pains in the knee, Bell's palsy with periodic fever, paralysis of the extensor muscles of the right hand,

with the development ultimately of typical intermittent fever. In all of these cases but one the malarial parasite was found in the blood, sometimes only after repeated examinations, and quinine caused prompt recovery. R. A. Goodner (Med. News, Dec. 17, '98).

If two drops of malarial blood (or one of malarial and one of healthy) are placed on cover-glasses and then brought into contact and closely pressed together to get a uniform layer, in less than a minute the red corpuscles group themselves into masses of from 3 to 5 up to 80 to 100 or more. The leucocytes take no part, and if they are included in one of the masses they are surrounded by a zone free from cells, as if they exercised a negative chemotactic force. The ordinary roulette arrangement is never met with in a well-made malarial preparation. Grixoni (Gazz. degli Osped., May 12, 1901).

Diazo-reaction in malaria studied during the recent epidemic in Algiers. In judging the results of the reaction not only was notice taken of the color of the body of the liquid, but especial attention was given to the coloration of the foam produced by violent agitation. Seventy examinations of forty-four consecutive cases reported. The observations were made both before and after the crisis of the disease. Of these examinations 47 gave negative results, 15 were doubtful, 7 were slightly positive, and 1 gave a reaction of fair intensity. This method rarely fails to give a differentiation between malaria and typhoid, and is of value when bacteriological methods are inaccessible or fail. J. Brault (Comptes Soc. Biol., Nov. 8, 1901).

Study of the agglutinating property of the blood of malarial patients. The blood or the serum of a healthy man mixed with the blood of another healthy man does not produce any agglutination. The serum of a healthy man acquires the agglutinating property when it is obtained in a manner which injures the red blood-cells. The addition of a solution of sodium chloride, containing 1 per cent. of a quinine salt, to the blood or the serum of a malarial patient

destroys the phenomenon of agglutination. This property may serve as a means of diagnosis between the serum or blood of a healthy, and that of a malarial, person. In the malarial serums so treated the failure of the agglutinating phenomenon to disappear indicates the presence of another infectious process. D. Lomonacio and L. Panichi (Riforma Medica, Feb. 11, 12, and 13, 1902).

Analysis of 195 cases of latent and masked malarial fevers. In the writer's series the blood-examination determined the diagnosis in all cases. One hundred and fifty of these patients were found to be suffering from æstivo-autumnal infections, 44 from tertian infections, and 1 from quartan infection. Fifty-five of these cases had been wrongly diagnosed as chronic dysentery; 19 as chronic diarrhœa; and a list of some thirty diseases is given for which these latent and masked cases of malaria were at first diagnosed. The source of infection was traced in 180 cases; 120 suffered from their first attack in the Philippine Islands, while 60 gave a history of having their first attack in Cuba. C. F. Craig (Medical Record, Feb. 15, 1902).

The necessity for examination of the blood in making a diagnosis of malaria emphasized. In one series of 7000 cases suffering from various ailments malarial fever was stated to exist as the cause of admission, or as a complication thereof, in from 54 to 55 per cent. of all cases, the maximum being in January and February of each year, the minimum in July and August. Upon the arrival of a competent pathologist the average fell to about 10 per cent., and remained in that vicinity until the pathologist departed, when it immediately rose again. The diagnosis reached during the time of the pathologist's stay had been by means of the microscope only, due allowance being made for the recent use of antiperiodics, spontaneous convalescence, etc. The diagnosis reached at other times was clinical. Ford (Medical Record, April 5, 1902).

The writer divides his 66 cases into the following three classes: Those in which the diagnosis of malaria was clear

from the beginning, those in which the diagnosis was made only after a blood examination had been made, and those which were not malarial. A percentage of large mononuclear leucocytes above 12 is diagnostic of malaria. The lymphocytes are usually increased; the total leucocytic count is diminished; myelocytes are frequently present to an appreciable extent; the erythrocytes are diminished; but the hæmoglobin is not much diminished, the color index often being above 1. If, in a malarial case, the fever is very recent, the blood-changes may not have had time to develop. If leucocytosis is present from any cause, the 12 per cent. of large mononuclears may appear not to be present. If the temperature is 103° F. or more when the puncture is made, the above conditions may not be found. D. W. Keiller Moody (Brit. Med. Jour., March 28, 1903).

Complications and Sequelæ.—Complications are, in great part, the result of mixed infections with other morbid agents, and comparatively few are due to the direct action of the malarial toxin, although some may arise from causes that are purely mechanical.

The complications of malaria involve, with the greatest frequency, the following organs in the order given: The digestive tract, the genito-urinary system, these two systems are involved with equal frequency; the heart and blood vascular system; the respiratory system; nervous system; diseases of the bones, muscles, and joints; diseases of the skin; diseases of the lymphatic system; diseases of the organs of special sense; diseases of metabolism—noticeable among these are diabetes and amyloid degeneration. John C. Hemmeter (American Medicine, Nov. 14, 1903).

THE LUNGS.—Croupous pneumonia and broncho-pneumonia may occur as true complications of malaria, and are then, of course, to be considered as due to secondary infections, and not as a result of the specific malarial toxin. The latter may render the person more sus-

ceptible to pneumococcic infection by impairing the general resistance, but no more intimate relation exists between the two diseases. Of course, the conditions already described as associated with the pneumonic form of pernicious fever in all probability depend upon the localization of the parasite in the pulmonary blood-vessels and are therefore directly due to the malarial infection; but this is not a true pneumonia and is unaccompanied by the signs of consolidation.

The association of *pleurisy* and malaria may occur and, as with pneumonia, is to be regarded as purely accidental and in no wise a consequence of the original infective process.

Tuberculosis.—The malarial subject is equally as liable to pulmonary tuberculosis as the non-malarial. This is contrary to the views held by early observers, who, following the lead of Boudin (*Traité des Fièvres Intermittentes*, Paris, '42), adopted the view that the two infections were in some manner incompatible with each other. As a matter of fact, in warm climates where malaria prevails its association with tuberculosis is uncommon because the climatic conditions are such as limit the occurrence of this infection, and in regions where tuberculosis prevails malaria, as a rule, is infrequent. To climatic conditions, therefore, rather than to any antagonism between the two infections is to be ascribed their relatively infrequent association in the same subject.

TYPHOID FEVER.—The relations between typhoid fever and malaria are the same as between malaria and other infective processes. From our present knowledge of malarial fever and the aid in diagnosis afforded by the microscope we know that there is no distinct clinical type of the disease to which the term typho-malaria may be properly ap-

plied. The class of cases, the continued forms of æstivo-autumnal fevers, which have been the source of so much confusion respecting the two infections, have already been referred to. The examination of the blood in these cases and the action of quinine afford means of diagnosis as easy of application as they are decisive in results. An acute malarial infection or the lighting up of an old one may occur in the course of typhoid infection, and the symptoms of the latter may be so modified as to indicate the character of the complication, but the two infections complete their course independently of each other and their association does not give rise to a new clinical or pathological entity.

Infections other than typhoid fever, such as the eruptive fevers, acute rheumatism, and the like, bear the same relation to malaria.

CHRONIC MALARIAL CACHEXIA.—As the result of neglected cases of malarial fever, usually of the æstivo-autumnal variety, or as the result of inadequate treatment by quinine, a series of relapses occur which eventually give rise to such impairment of the general health as to establish a chronic cachexia. This is the most frequently met with sequel to malarial fever and first manifests itself as an anæmia, which, if the cause be not removed, may develop to the gravest proportions. The patient's appearance becomes distinctive, and, with the evidences of profound anæmia, the skin presents a sallow or muddy color; the mucous membranes are all but colorless, while the extreme exhaustion, breathlessness upon the slightest exertion, headache, and subcutaneous œdema indicate the gravity of the changes that have occurred in the blood. Digestive disturbances are common and the tongue is frequently coated. Great enlargement of the spleen,

the most pronounced that may be encountered, occurs in this condition, giving rise to the popular term of "ague-cake." Neuralgia, especially of the supraorbital and intercostal nerves, is a common incident and the occurrence of vertigo upon any sudden change of position may interfere with the patient's locomotion. In advanced cases dropsical effusions into the serous cavities may take place, while marked emaciation, exhaustive diarrhœa, anorexia, and profound asthenia render the patient particularly susceptible in intercurrent infections.

Chronic malarial cachexia may pursue throughout an afebrile course or it may be punctuated by irregularly-recurring paroxysms of mild pyrexia; in still other instances an irregular, subfebrile temperature may exist for a long period. While any variety of malarial infection may be followed by cachexia, it usually occurs as a sequel to the æstivo-autumnal. The blood-examination may be negative. In æstivo-autumnal infections, however, crescents and ovoid bodies are nearly always found, while in other infections pigmented leucocytes and a few parasites are usually to be seen.

RELAPSES.—This sequel has already been referred to as arising from the failure to pursue treatment sufficiently to destroy all the parasites at the period of sporulation, so that the parasites thus escaping continue to pass through successive cycles of development until a group is produced of sufficient size to cause the toxic manifestations constituting a paroxysm. There are other instances, however, in which the relapse takes place a long time after the termination of the original paroxysm, and such instances have been ascribed to the persistence of some form of the parasite within some of the internal organs.

ANÆMIA.—In addition to the changes in the blood indicative of secondary anæmia of a grave type, in certain instances the alterations characteristic of progressive pernicious anæmia occur; the termination of such cases is, of course, a fatal one.

HEPATIC SEQUELÆ.—The malarial infection is undoubtedly the basis for hepatic changes in a certain number of cases. These changes have already been referred to, and as they are usually unaccompanied by clinical manifestations, further reference to them need not be made.

NEPHRITIS.—Some involvement of the kidneys usually occurs in very grave malarial infection. Nephritis in its most intense forms is to be found in association with malarial hæmoglobinuria, and, as already stated, may then prove rapidly fatal. In ordinary cases, however, recovery ensues without permanent damage to the organs.

AMYLOID DEGENERATION.—Amyloid degeneration is of infrequent occurrence as a sequel to malaria. Of the 145 cases of amyloid degeneration in the Collective Statistics of Fehr only 4 could be ascribed to malarial infection; and of 43 cases reported by Rosenheim only 4 followed this infection (Mannaberg).

MENTAL DISTURBANCES, disorders of the special senses, peripheral neuritis, cerebral and spinal paralyses may occur as post-malarial manifestations. As a rule, their tendency is toward complete recovery.

Six cases of paralysis of the bladder occurring in the course of malarial affections. Patients were all men, and mostly those past middle life. Sometimes the paralysis came on in the course of malarial fever; in other instances it was the first symptom of malarial infection. Once it had appeared, it did not subside until the malarial trouble was entirely cured, and then it disappeared as suddenly as it

had set in. Marion (N. Y. Med. Jour.; Medical Bull., Dec., '97).

Retinal lesions found in the graver forms of malarial poisoning: swelled arteries and veins, perivascular œdema, and sometimes swelling of the papilla itself. In the blood of the retinal vessels were found the well-known changes in the red blood-corpuscles characteristic of malaria. Guarnieri (Arch. per la Sci. Med., No. 1, '97).

Diagnosis between quinine and malarial amblyopia can only be made by an examination of the fundus of the eye. By this method retinal alterations are found like those observed in patients suffering from malarial disease, or simply ischæmic troubles, as in cases of quinine intoxication. It is very rare that amaurosis due to malaria shows a tendency to remain and becomes permanent, while quinine amblyopia, even when it is not permanent, persists for a considerable time. Ischæmia of the disk constitutes the true pathognomonic sign of cinchonic intoxication. If nerve-atrophy is accompanied by marked contraction of the retinal vessels, and the ocular trouble has immediately followed the malarial manifestations which call for necessary energetic quinine medication, the patient is suffering from quinine amaurosis. Juan Santos (N. Y. Med. Jour., May 14, '98).

The disturbances of speech mostly observed in malaria occur in the form of ataxic aphasia. A simple difficulty of speech or stammering is of rare occurrence. Disturbances of speech are more frequently observed in connection with the malignant forms of the disease. They occur either together with the paroxysm or at the height of the disease; rarely at the end of it. Malarial aphasia is more frequent in men than in women. It is frequently accompanied by paralysis. Malarial aphasia is usually temporary, is of short duration, and entirely recovered from. I. E. Tiknadze (Phila. Med. Jour., June 29, 1901).

Malarial neuritis presents most of the symptoms familiar in other toxæmic forms of neuritis. In the differential diagnosis the following points are important. In malarial neuritis: 1. The course of the disease is intermittent,

these intermittences corresponding to the febrile accesses. 2. The tendon-reflexes are frequently preserved, and may even be exaggerated; tremor, ataxia, and athetoid movements in the paretic limbs are not uncommon, and at the onset there may be bulbar symptoms. 3. The sensory disturbances are irregular and dissociated, sometimes grouped according to the wearing of gloves or stockings, and frequently suggestive of hysteria. 4. The rarity of complete reaction of degeneration in the paralyzed muscles. 5. The frequency of vasomotor and trophic disturbances. 6. The almost constant failure of sphincter trouble. These are the chief directions in which malarial neuritis may be separated from other forms of neuritis. Schupper (Il Policlinico, H. 5, f. 4, 1902).

Prognosis.—The prognosis of malaria is influenced by a number of conditions the most important of which is the variety of parasite to which infection may be due. Thus, the prognosis of ordinary quartan and tertian fevers when properly treated is almost always favorable, although even these milder forms of infection, if treatment be neglected or inefficiently carried out, may be followed by cachexia or anæmia of severe grade. As already mentioned, however, the tendency in these infections is toward spontaneous recovery. *Æstivo-autumnal* infections, on the other hand, show this tendency to a much less degree, and if left to themselves are much more likely to pass on into one of the grave post-malarial conditions, or to develop pernicious manifestations; nevertheless the prognosis of ordinary *æstivo-autumnal* fevers, when properly treated, is favorable, although it must be borne in mind that in this infection greater activity of treatment is demanded.

In the pernicious fevers the prognosis is always grave and can never be considered as favorable until that period of time has passed during which the occur-

rence of a second paroxysm is likely. These cases, of course, call for the greatest activity in treatment, and upon the efficiency with which this is carried out the prognosis largely depends.

The grave anæmias occurring as sequelæ of malaria are events which should cause the deepest concern regarding ultimate recovery; their course is only too apt to show progressive tendencies. The prognosis of chronic malarial cachexia depends largely upon the patient's ability and willingness to take advantage of changed climatic conditions.

Malaria is a disease that rarely kills in the large towns of the Atlantic sea-board. William Osler (Internat. Med. Mag., Jan., '96).

Malarial infection in Cuba is extremely severe, and attacks all of the population. It continues for an indefinite time, aggravates all associated disorders, and one attack predisposes to another. The victim of paludism has his powers of resistance lowered, and, while the immediate mortality is comparatively small, yet to it must be added a large number of deaths which are to be attributed to malarial cachexia and intercurrent complications. J. M. Espada (Jour. de Hygiene, June 22, '99).

Treatment.—In cinchona and its derivatives, more particularly quinine, we possess a remedy against malaria that may be regarded as a true specific. That quinine owes its efficacy in malaria to the destructive influence which it exerts upon the parasite is now agreed to by all observers. The changes in the parasite resulting from its administration have been given close study by Laveran, Golgi, Romanowsky, Marchiafava, Bignami, Mannaberg, and others. The action is most marked upon the young extracorpuseular bodies and very slight upon the parasite during the corpuscular phase of its existence. This is true not only of the parasites of the regularly intermittent group of fevers, but is also

true of the parasite of æstivo-autumnal fever. It follows, therefore, that the administration of quinine a few hours before an expected paroxysm will not prevent its occurrence, because at the time of its administration the parasites being within the corpuscles are in that phase of their cycle of existence during which they are the least susceptible to the action of the drug. Segmentation is not prevented, therefore, and the paroxysm occurs, but the resulting free young segments are destroyed and their further evolution cut short, so that the next succeeding paroxysm is averted.

After the administration of quinine the active movements of the amœboid parasite, particularly of the tertian variety, are observed to lessen, while the pigment tends to clump and the parasite becomes more highly refractive. At the same time the parasites are much diminished in number and present the evidences of degeneration, hydropic and fragmented forms prevailing.

The mode of administering quinine is to be regulated in accordance with the exigencies of the case. In the milder forms of infection its administration by the mouth is the preferable mode, while in cases of severe grade, where quick action of the specific is all-important, and in cases in which the drug induces vomiting, its hypodermic administration is demanded. By the mouth quinine is best given in solution, notwithstanding its bitter taste, as in this form only will its prompt absorption be absolutely assured. If given in capsule, or as the much-resorted-to quinine pill, at best the absorption of the drug is delayed and at the worst may be passed off by the bowel within the undissolved capsule or pill-coating. Under certain circumstances it may be deemed advisable to give quinine in the form of rectal enemata; this is

the least certain of all the methods of administering the drug, however, and should only be employed when for some reason its administration by one of the other methods is contra-indicated.

Microscopical observation of the effects of quinine on the blood of malarial patients (quartan type), who have not been treated with quinine: As the red corpuscle is necessary for the life of the parasite, quinine, by driving the parasite out of its element, places it under conditions unfavorable and destructive to its development. Therefore quinine should not be given in the febrile stage of the disease, but during the non-febrile intervals, when the early forms of the parasite are present in the blood in greatest number. Lomonaco and Panichi (Centralb. f. d. med. Wissensch., Aug. 19, '99).

The special effect of quinine in malaria can hardly be explained as a direct outcome of its toxicity with regard to plasmodiæ, although this undoubtedly is very considerable, and if an explanation of this effect is looked for, a peculiarity so distinct as the power to make microorganisms sensitive in relation to light must not be left out of consideration.

Quinine preparations have decided sensitiveness-arousing qualities. Ullmann's investigations show, for instance, that paramæciæ, which are placed in solutions of quinine of $\frac{1}{20000}$, first die after about five hours when standing in the dark, while they are killed in the course of eight minutes if placed in sunlight, under conditions which generally have no baneful effects upon paramæciæ.

According to Jacobson's and Dreyer's experiments, light, even after having passed through a layer of animal tissue, can exercise its microbicidal effect upon the sensitive-made organs. The depth at which it may be possible to obtain an effect will, of course, among other things, depend upon the intensity of the light.

The tissues of the human body are pellucid, and even if only a comparatively small portion of the surface of the body is exposed to light, the blood,

and with it the plasmodiæ, will, on account of its continuous circulation, all the same be affected by the light.

The writer states that if the correctness of his views should be confirmed by clinical experiments, they indicate the advisability of treating malarial patients with sun-baths or electric-light baths, in addition to quinine. Gunni Busek (*American Journal Medical Sciences*, July, 1904).

The choice of the particular salt of quinine to be given is a matter of some importance, as they are found to differ widely in the degree of their solubility and the percentage of the alkaloid which they contain. Although but very slightly soluble in water, the sulphate of quinine is the form most commonly employed. It is, however, readily soluble in acid solutions; so that when given in water it is customary to add sufficient sulphuric acid to effect its solution.

Quinine is a specific for all forms of malarial infection. W. S. Thayer (*N. Y. Med. Jour.*, Nov. 20, '97).

The susceptibility to quinine exhibited by some persons can be nearly always overcome by giving quinine with hydrobromic acid or the bromides—for example, twice as much bromide of sodium as quinine. Muriate of quinine favored instead of the sulphate. Andrew H. Smith (*Med. Rec.*, Jan. 15, '98).

Fifteen grains of quinine with 15 grains of powdered ginger twice a day, and three doses of $\frac{1}{2}$ ounce of camphorated tincture of opium given in 47 cases of malaria. Twenty-two were cured at once, 5 within 24 hours; 10 within 48 hours, and 12 of the remaining 15 at later periods; 3 were not benefited. No relapse occurred in any case. The parasite found in most of these cases was of the æstivo-autumnal type. In 6 cases there was mixed infection with typhoid and malaria; 4 of these got well of the malaria during the course of the typhoid, and in 2 the malaria reappeared after convalescence from the typhoid fever. W. H. Thompson (*Med. News*, Dec. 17, '98).

Quinine should be administered only when required, and then given in sufficient doses to destroy the parasites in the blood. The incubative period of malaria is certainly not less than five days; therefore a person visiting a malarious district should take from 7 to 15 grains (0.46 to 1 gramme) of quinine at bed-time on the fourth day, and he should repeat this every fourth or fifth day during his stay in the place or until cold weather puts a stop to the liability to infection; he should also sleep under a mosquito-bar and stay in-doors after sundown.

Small daily doses of quinine, 1 to 2 grains (0.06 to 0.12 gramme), simply habituate the parasites to the presence of the drug in the blood, and they continue their evolution in its presence.

Then an acid solution of quinine is to be used.

Quinine, when combined with camphor and capsicum, will cause the disappearance of the malarial parasite from the blood more quickly than quinine alone.

In the continued or remittent æstivo-autumnal fevers the patient is personally put on the following prescription. It must be compounded exactly as written and *not filtered*. When properly made, it looks like buttermilk, and must be shaken each time before using:—

R Magnesium sulphate, $\frac{1}{2}$ ounce.

Solution of ammonium acetate, 1 ounce.

Quinine sulphate, 4 grains.

Camphor-water, enough to make 11 ounces.

M. Sig.: Two tablespoonfuls every four hours, fever or no fever.

This prescription is good in any form of acute malarial disease, but is preferred in cases in which the fever is continued or in which the patient cannot take full doses of quinine, on account of head symptoms. It produces a gentle perspiration, keeps the bowels open, reduces the fever, and nearly always affects a cure. W. P. McIntosh (*New York Med. Jour.*, Nov. 30, 1901).

When administered hypodermically the neutral hydrochlorate of quinine is

to be preferred on account of its greater solubility, 1 part being soluble in 0.66 parts of water. The following solution is recommended by de Beurmann and Villejean for this purpose:—

℞ Quinine dihydrochlorate, 75 grains.
Distilled water, enough to make
2 1/2 drachms.—M.

One cubic centimetre (15 minims) of this solution represents 0.50 (8 grains) of quinine dihydrochlorate. (Laveran.)

The intravenous injection of quinine has been advocated by Baccelli, but, as pointed out by Laveran, it should not be resorted to “except in the very severe pernicious paroxysms and when there is reason to fear that even the hypodermic method will not effect a sufficiently-rapid introduction of the salts of quinine into the blood.” Baccelli recommends the following solution:—

℞ Quinine hydrochlorate, 15 grains.
Sodium chloride, 12 grains.
Distilled water, 2 1/2 fluidounces.
—M.

This solution is, of course, to be injected warm.

For certain pernicious forms of malaria the intravenous injection of a neutral salt of quinine should be given:—

℞ Quinine hydrochloratis, 15 grains.
Sodii chloridi, 1 grain.
Aquæ destill., 2 1/2 drachms.—M.

This may be injected into the veins in progressively diminishing doses. Baccelli (*Wiener med. Woch.*, Jan. 11, '90).

The treatment of chronic malarial fever by subcutaneous injections of quinine bihydrobromate is of remarkable efficacy. It is not very painful if the bihydrobromate salt is used. The bihydrobromate is perfectly stable, and makes a solution (1 in 6) that is only faintly acid. The method personally followed is to inject subcutaneously 3 grains (0.20 gramme) of quinine bihydrobromate dissolved in 20 minims (1 1/3 cubic centimetres) of pure warm water.

It is first injected under the skin of the upper arm, then under that of the thighs, then under the skin of the abdomen, or at the top of the chest or between the scapulæ. Six injections on alternate days are usually required in a serious case, and 3 grains under the skin will prove much less distressing and more curative than 30 by the mouth. A syringe should be kept for the purpose, and should be used for nothing else. The syringe and the patient's skin are disinfected with strong carbolic lotion and also the physician's hands. The needle is sterilized in the flame of a spirit-lamp. The solution of quinine is sterilized when first made, and may be boiled each time before using. The dose of 3 grains may be exceeded on special occasions or it may be given several times a day, but it will usually be sufficient.

The excretion of quinine through the kidneys begins a few minutes after a dose has been given, and it is this fact that explains the superior results from its subcutaneous use. Slowly absorbed through disordered stomach and intestinal membranes, it is excreted nearly as fast as it is absorbed, and never reaches in the blood the strength sufficient to destroy the malarial plasmodia. Quinine subcutaneously affects the head less also. It is advisable to give the injections two or three hours before the expected paroxysm, though in chronic cases it does not seem to matter much when one injects, provided that it is done often enough. G. B. Ferguson (*Brit. Med. Jour.*, Feb. 22, 1902).

The administration of quinine should be so timed that the maximum influence of the drug shall be obtained at the time of the sporulation of the parasites, for the reason, as has just been said, that it exerts but little toxic influence upon the parasites as long as they remain within the blood-corpuscles. The drug is given, therefore, not with the hope of averting the pending paroxysm, but with the purpose of destroying the free young segments upon which the succeed-

ing paroxysms will depend. In the fevers of the regularly intermittent variety this object is readily accomplished, and even small doses of the drug will frequently prove quite sufficient. It is well, however, to vary the dose somewhat in accordance with the severity of the case even in this type of fever; so that, while in the milder cases 2 grains given three times daily will prove effective in breaking up the paroxysms, in the cases of a somewhat more severe infection it may be well to give 5 grains three times daily. It is at times advisable in this latter class of cases to give a large dose of quinine at the expected time of the paroxysm, and, after having thus for several days prevented its occurrence, to continue the use of the drug in small doses three times daily for several weeks. It is claimed by Laveran that the type of fever should not cause any very marked variation in the manner of the administration of quinine, either as regards the dosage or the time of taking. Thus, for a male adult he advises the following practical directions: "On the 1st, 2d, and 3d days from 80 centigrammes to 1 gramme (12 to 15 grains) of quinine hydrochlorate daily in the course of twenty-four hours; on the 4th, 5th, 6th, and 7th days no quinine; on the 8th, 9th, and 10th days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate; from the 11th to the 14th day no quinine; on the 15th and 16th days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate; from the 17th to the 20th days no quinine; on the 21st and 22d days from 60 to 80 centigrammes (9 to 12 grains) of quinine hydrochlorate."

Segmentation occurs at or about the time of the paroxysm; hence the quinine should be given shortly before it in order that it may be in solution in the blood when segmentation takes place. In this

way a group of organisms may be almost entirely destroyed by a single dose. It is advisable to give a second dose just before the time at which the next paroxysm would occur. Fifteen or 20 grains may be given for the first dose and 10 grains for the second. J. L. Morse (Boston Med. and Surg. Jour., Jan. 16, '96).

In order to suppress attack of typical intermittent an adult is to be given 25 grains of quinine. In cases of masked malaria it may become necessary to increase the dose, even up to 50 grains. Quinine is to be given, at the very least, six hours before the ensuing attack. J. Ballagi (Indian Lancet, Dec. 16, '97).

To master malaria, 15 grains of quinine should be given to the sufferer from malaria in the afebrile intervals, therefore almost always in the morning hours, until the malarial parasites have disappeared from his blood; then follows an interval of seven days; then again 15 grains of quinine on each of two of successive days; then another seven days' interval; again two days of drugging with quinine, and so on, for at least two months. Robert Koch (Deut. med. Woch., Apr. 26 and May 3, 1900).

In the æstivo-autumnal fevers treatment should be more actively pursued and larger doses of quinine employed. Owing to the irregularity in time with which the parasites undergo segmentation quinine should be given irrespective of the occurrence of the paroxysm, so that its administration may be commenced in doses of 5 grains every four hours as soon as the case comes under observation. If the case be very severe and pernicious manifestations feared, several larger doses of the drug (15 grains) may be given at intervals of a few hours either hypodermically or by intravenous injection, while subsequently its use may be continued in smaller doses. If pernicious symptoms have already occurred, no chances that the drug may be absorbed through the stomach should be taken; it is imperative under these circumstances to administer it un-

der those conditions most favorable to its rapid absorption; that is, by hypodermic or intravenous injection after the method of Baccelli.

In pernicious malaria cinchonism should be produced as rapidly as possible, and, since the temperature-variations are exceedingly irregular, large doses are necessary. The stomach will rarely accept the necessary doses, and hypodermic and intravenous injections (Baccelli's method) are to be considered. Great depression should be combated by strychnine and digitalis, and patient sustained by enemas of whisky, peptonized foods, and broths. Clarence J. Manly (Ther. Gaz., Dec., '97).

The exhibition of such large doses of quinine as were at one time believed to be necessary deprecated; even in the tropics 30 to 45 grains of quinine *per diem* are sufficient, while here, in the northern half of the United States, the milder intermittents are often checked by a single dose of 5 grains, more certainly with 10. In general, however, 15 grains may be looked on as an average dose in such cases. In the severe and more obstinate æstivo-autumnal forms 20 grains a day may be taken as the normal dose. It is best to administer that amount at one dose, or within a time not longer than two hours. Dock (Jour. Amer. Med. Assoc., July 29, '99).

Notwithstanding the fact that quinine is held by some observers to be directly responsible for the hæmorrhagic phenomena characterizing malarial hæmoglobinuria, no particular modification of the treatment should be made in the management of these cases. In a general way, the same treatment that is applicable to the other forms of pernicious fever is to be employed in malarial hæmoglobinuria.

In treatment of hæmoglobinuria in malaria persulphate of iron and inhalations of oxygen are the most useful. If the malarial attack necessitates quinine its continuance is advised even in spite of hæmoglobinuria. Baccelli (Il Policlinico, Jan. 15, '97).

Quinine objected to in malarial hæmaturia, and following treatment recommended: 1. Sodium hyposulphite in drachm doses every two hours until the patient is thoroughly purged; continued in smaller doses until the system is saturated with it. Free sulphurous acid is disengaged in the blood, and this agent is an antizymotic to such an extent that it destroys the micro-organisms that are the real cause of the disease, and thus arrests the process of corpuscular disintegration. 2. Morphine and atropine hypodermically, sufficient to quiet the stomach; and blisters over the epigastrium, if necessary. 3. An abundance of water to wash out the coagula that must necessarily accumulate in the urinary tubules after a hæmorrhage. Hot water or hot lemonade is frequently better borne by the stomach than cold. Cupping over the loins is also to be recommended. 4. A mild diet; fresh buttermilk is usually well borne. 5. The patient should remain in a strictly recumbent position. Meek (Ther. Gaz., May 15, '97).

Tyson recommends quinine in malarial hæmaturia and believes that this symptom is due to another cause than quinine. Albert Woldert (Med. News, Apr. 30, '98).

Quinine acts nearly as a specific in all malarial fevers characterized by intermissions or well-marked remissions, but fails in continued fevers, those with typhoid-like symptoms, those malarial conditions without high temperature, and the cachexias and anæmias due to malaria.

Quinine should never be used in hæmoglobinuria, or given subsequently to one who has suffered from it. J. S. Van Marter, Jr. (N. C. Med. Jour.; Louisville Med. Monthly, Sept., '98).

Quinine should not be given in malarial hæmaturia. The injudicious administration of quinine is often responsible for an hæmaturic attack. M. Goltman and William Krauss (Memphis Lancet, Dec., '98).

The Indian jail experience has settled that it is possible to daily administer preparations of quinine for many months at a time without the slightest mischief

resulting. For the past five years quinine or cinchonidine has been personally administered daily to, on the average, over 1600 prisoners for the four months of the rainy season, and never has a single bad result been met with; even severe cases of quininism are conspicuous only by their rarity. It is needless to say that, in spite of Professor Koch's alarmist views on the subject of quinine and hæmoglobinuria, there has not been a single case in personal experience, nor has there been found after inquiry, such a case since the practice was introduced into the prisons of India. W. J. Buchanan (*Brit. Med. Jour.*, Sept. 1, 1900).

In the management of chronic malarial cachexia much often depends upon the ability or willingness of the patient to remove to a non-malarious and healthy climate. Indeed, in some instances the adoption of such a course is absolutely necessary to effect a cure. At the same time quinine in small doses should be taken for a long time to destroy the parasites remaining in the blood and organs, and measures should be adopted to overcome the profound asthenia and anæmia. The indications of the former are usually fully met by the administration of bitter tonics and an abundant and nutritious diet, while the latter usually calls for the use of arsenic; indeed, in this condition a long-continued treatment with arsenic in ascending doses often proves most effective; not only is this remedy of value in the treatment of the anæmia incident to chronic malarial cachexia, but it is also to be employed in the same manner to combat the anæmia that is of such common occurrence during the convalescence from the acute forms of infection.

Four cases of malarial cachexia treated with the spleen and bone-marrow of cattle, with apparently favorable results. Gritzmann (*Allg. Wien. med. Zeit.*, June 30, '96).

Of 5 cases of malarial cachexia treated with hypodermic injections of citrate of

iron, four cases recovered completely. The fifth was greatly improved. Naame (*Rev. de Méd. de Paris*, Mar. 10, '97).

Certain symptoms arising during the course of a malarial paroxysm may call for special treatment, but the indications to be met are only those to which general principles may be applied and hardly seem to call for particular mention.

Various substitutes for quinine in the treatment of malaria have been advocated, including the other derivatives of cinchona, methylene-blue, arsenic, strychnine, iodine, and a number of others. All of these, however, are far inferior to quinine in their antimalarial action, and, with the exception of arsenic under the conditions already mentioned, possess a very limited applicability.

Of 2501 men on whom arsenic was tried, 579 were suffering from acute and 1384 from chronic malaria. The remaining 538 were free from the disease. In the acute cases arsenic was of little use, but it gave excellent results in the chronic cases, and in the others it seemed to confer immunity, or, if they contracted the affection, it was of a mild type and easily cured with quinine. The men put on flesh, and lost the pallid, cachectic look characteristic of dwellers in malarial regions. Daily administration of arsenous acid increases the resistance of the organism to the action of the microbes of malaria. Ricchi (*Brit. Med. Jour.*, Apr. 27, '89).

Nitrate of potassium very efficient in the treatment of chills and fever. Sixty-five per cent. of personal cases cured with a single dose; 35 per cent. were uninfluenced by repeated doses. Best results were obtained when the drug was administered during the premonitory stage, in anticipation of the paroxysm. Twenty-five or 30 grains at this period will abort the attack or modify its course and intensity. Hunter (*N. C. Med. Jour.*, Mar., '90).

Successful employment of methylene-blue. Seven and one-half grains were given six hours in advance of the time of the expected attack, and, subsequently,

1½ grains or more five times daily. Guttman and Ehrlich (Wiener med. Woch., Oct. 24, '91).

Methylene-blue unsuccessfully employed in five cases, in hourly doses of 1.5 grains five or six times, as many hours in anticipation of the paroxysm. While it appeared to control the paroxysm, it did not prevent recurrence. Its use was also attended with irritability of the gastro-intestinal and genito-urinary tracts. Ketli (Ungarisches Archiv f. Med., B. 2, H. 1, '93).

Methylene-blue employed in thirty-five cases of intense malarial fever: the drug exercises an influence upon the plasmodia, as these were found to disappear and the paroxysms not to recur. The remedy was administered internally, or injected subcutaneously. The injections were given twice daily, 15 grains of from a 1-per-cent. to a 5-per-cent. solution of methylene-blue being used on each occasion. The paroxysms did not recur after from three to five injections had been given. By the mouth capsules containing 6 to 7.5 grains were given twice or thrice daily. Unpleasant symptoms, such as headache, anorexia, and vomiting, were in some cases observed to occur after internal administration. Porenski and Blatteis (Ther. Monats., Jan., '93).

Phenocoll is as effective as quinine in malarial-fever state, whereas quinine, in many instances, gives rise to toxic symptoms. Phenocoll has not been found to give rise to such unpleasant effects. Phenocoll succeeds in a certain number of cases in which quinine absolutely fails. The taste of the drug can easily be masked by means of syrup, and is not objected to even by children. Dall (Gazzetta degli Osp., Jan. 14, '93).

Sixty-one children were treated with helianthus, in the form either of an alcoholic tincture or of an alcoholic extract. Of the former, from ¼ to 2½ drachms were given daily in divided doses in a potion, and, of the latter, from ¼ to 1½ drachms. The remedy was well borne, even by the youngest infant. In the majority of cases the cure was as prompt as with quinine. Methylene-blue was administered to 36 children, varying in age from 23 days to 14 years. A cure was obtained

in 10 cases, amelioration in 3, while in 14 the results were not conclusive. The drug was given in doses of from 3¼ to 6 grains in four equal parts, in the course of the day. The medicament was well borne and only in 1 case caused transient vesical tenesmus. Moncorvo (Le Bull. Méd., Jan. 15, '93).

Upward of forty cases in children treated with methylene-blue, with entirely satisfactory results. Dose employed varied from 4 to 7½ grains in the course of twenty-four hours, according to the age of the patient and the severity of the attack. The drug was of especial value in protracted and obstinate cases that resisted treatment by other means, and in cases of intermittent and remittent not sufficiently severe to be of immediate danger to life. In pernicious cases it would be judicious to join the subcutaneous injections of quinine bihydrochlorate. Its administration should be continued for several days after the subsidence of the fever and the disappearance of the other symptoms. It may be given in solution in syrup of orange-peel and syrup of canella. To larger children it may be administered in tablet, cachet, or capsule. Ferreira (Bull. Gén. de Thér., June 15, '93).

Living malarial parasites subjected, under the microscope, to the action of a solution of quinine 1 to 5000, and of a solution of methylene-blue 1 to 20,000. The former did not at all affect the movement of the plasmodia, not even after ten hours; the latter destroyed it very soon, and in about half an hour the microbes were stained a beautiful blue. H. Rosin (Schmidt's Jahrbücher, May 15, '94).

Phenocoll should be substituted in pregnant women suffering from malaria, this drug having no action on the uterus; in doses of 22 grains divided in 4 cachets, to be taken 5, 4, 3, and 2 hours before a febrile paroxysm is due. Titone (Rif. Méd., Nov. 24, '94).

In children hydrobromate of quinine of service in same doses as other salts of the alkaloid. Especially useful in nervous, excitable children. Solubility further promoted by association with antipyrine. Comby (La Méd. Mod., Aug. 28, '95).

Roux's serum employed in 2 cases of

quartan fever. In the first there were 2 subsequent rises of temperature and then complete cure. The second case, even after a second injection, showed no beneficial result. Treille (*Sem. Méd.* p. 312, '96).

Guaiacol used in the treatment of malarial intermittent fevers; 15 minims were rubbed into the axilla and covered with cotton. The average fall of temperature in $\frac{3}{4}$ hour was 1.6° , in $1\frac{3}{4}$ hours, 2.3° , and after 4 hours the average fall was 3° . The fall of temperature was accompanied by a free perspiration and a marked improvement in the condition and comfort of the patient. No depression was noticed. Rogers (*Ther. Gaz.*, May 15, '96; from *Indian Med. Gaz.*, Jan., '96).

Fifteen-minim doses of creasote, rubbed into the axilla and then covered with cotton-wool, used in eight cases of severe intermittent fever with temperatures varying from 103.2° to 104.4° F., the temperature being either stationary or rising at the time the drug was applied. In every case perspiration, usually free, was produced in from half an hour to two hours, and was accompanied by a marked fall of temperature, averaging 1.6° F. within $\frac{3}{4}$ hour, 2.3° after $1\frac{3}{4}$ hours, and 3° within 4 hours after the use of the drug. At the same time all the distressing symptoms, including the severe headache always present with high fever in these cases, were decidedly relieved. Leonard Rogers (*Brit. Med. Jour.*, Jan. 4, '96).

Seven cases of malaria treated with methylene-blue in doses of $1\frac{1}{2}$ grains, in capsules, given six or eight times in the day. The rapid cessation of the attack was striking. Microscopical examination showed that the plasmodia disappeared from the blood later than the febrile attacks. Duration of the treatment extended over 8 days as a minimum and 23 days as maximum. It was determined by the disappearance of the plasmodia and of the splenic enlargement. Rottger (*Deut. med. Woch.*, Apr. 9, '96).

Methylene-blue should only be used in simple intermittent fevers, and it would

be dangerous to substitute it for quinine in the treatment of continued fevers and in grave cases. It is only indicated, when, for some cause, the use of quinine is contra-indicated, especially when, even in small doses, it produces hæmoglobinuria. The daily dose in the adult is from 9 to 15 grains; sometimes it produces a slight cystitis that ceases when the drug is discontinued. Cardamatis (*Gaz. des Hôp.*, Apr. 15, '97).

Phenocoll, though no substitute for quinine as an antiperiodic in impaludism, has valuable analgesic properties, and in small doses distributed over the twenty-four hours, or preferably administered from three to five hours before the access, alleviates the pains of the ague-fit and in certain cases refractory to quinine has even shortened its duration. However, Quirogne has found that, even in moderate doses, phenocoll has the disadvantage of causing symptoms of collapse. Editorial (*Sem. Méd.*, No. 54, Nov. 17, '97).

In the treatment of mild forms of malarial fever, while the preparations of bark may not act so rapidly as quinine, they are often more efficacious. After the paroxysms have once been arrested they are not so apt to recur. If the bark is given continuously for several weeks the patient's general condition is much better than it is in those cases in which quinine in small or moderate doses has been persistently taken. B. Robinson (*Med. Rec.*, Jan. 15, '98).

Perfect cure in cases of undoubted malaria, which had proved intractable to quinine in large doses by small doses of nuclein (1 drop every two or three hours), which caused a prompt disappearance of the cachexia, migraine, gastro-intestinal disturbances, hæmaturia, general depression, and other so-called malarial symptoms under which the patients were suffering. Editorial (*Cincinnati Lancet-Clinic*, Apr. 30, '98).

Euchinin is superior to quinine in being tasteless and requiring a smaller dose to reduce temperature. It does cause cinchonism. In from 10- to 15-grain doses it is equal to quinine sulphate in 20- to 30-grain doses. St. George Gray (*Post-grad.*, May, '98).

Myrrh recommended, in the treatment of malaria, in the following formula: Quinine, 40 grains; pulverized myrrh, 20 grains; powdered licorice, 10 grains. Forty pills are made, one of which is to be taken every two hours. The myrrh increases the number of white blood-corpuscles, which are scavengers of the blood, and therefore more easily eliminate the malarial plasmodium. Aaron Jeffrey (*Med. Rec.*, Aug. 20, '98).

In those cases of malaria in which there is an idiosyncrasy to quinine, salicin and sodium salicylate are of great advantage. J. R. Gilbert (*Jour. Amer. Med. Assoc.*, Nov. 12, '98).

Creasote treatment for malarial fevers in children which combines everything that is necessary, even in very severe cases; it is easily applied, acts rapidly and continuously, and with certainty. Pure beech-wood creasote, 15 to 20 minims for a child of 1 year, or 30 to 60 minims for an adult, is mixed with an equal quantity, or more, of olive-oil, and rubbed, for from five to ten minutes, over the chest, abdomen, axillæ, and sides. The oil is only employed to counteract the tingling and burning occasionally produced by the creasote. A. O. Fitzgerald (*Brit. Med. Jour.*, July 15, '99).

Guaiacol surpasses any remedy so far recommended for malaria. In personal experience it has cured every case, in some of which quinine had been tried and failed. C. J. Whalen (*Merck's Archives*, Apr., 1900).

Methylene-blue will destroy malarial parasites in many cases, but is less certain than quinine, and it is probably most valuable in chronic cases, but has no advantage over quinine. The effects of methylene-blue are ordinarily more unpleasant than quinine. It is useful in cases that cannot take quinine on account of some idiosyncrasy to it. Its use in cases of pregnancy is undetermined. It is probably valuable in treating hæmaturic and hæmoglobinuric fevers on account of its diuretic action; this has yet to be determined. The writers have had no chance to test its use in such cases. They believe that quinine acts more quickly and is much

more certain and more reliable than methylene-blue. Moore and Allison (*Medical News*, Dec. 6, 1902).

Sodium salicylate in malarial fever reduces the temperature as quickly as quinine, if not more so, but is of the greatest value in relieving the acute pains in the limbs suffered from in malaria. It acts quickly and is sometimes successful where quinine fails entirely, or where it cannot be tolerated. The writer reports three cases of malaria in which he used sodium salicylate in conjunction with quinine sulphate, with markedly good results. Kennard (*Lancet*, July 11, 1903).

Prophylaxis. — General measures of prophylaxis may be adopted in accordance with the facts known of the etiology of the infection and which have been referred to in the section on that subject. Although recent researches all tend to prove that infection occurs by other channels than the alimentary tract, notably the skin, it is the part of prudence to sterilize by boiling water coming from infected regions. The prophylactic value of quinine is not to be overlooked, and infection may often be prevented by taking the drug in doses of 6 grains, or even less, in the twenty-four hours.

To reduce, as much as possible, the quantity of the malarial ferment that enters into the system through the air breathed is sought to be achieved by avoiding agricultural operations during those hours at which the malarious influence is most potent, viz.: about sunrise and sunset. Another point of the greatest importance is to avoid breathing the air in close contact with the soil, as the malarious poison rises only a short distance in a vertical direction. It is advisable to keep the windows closed in the morning and during the early hours of the evening, especially if any excavation should be going on in the neighborhood. Flowers should be entirely excluded from houses when malaria is rife, or the utmost vigilance should be taken to secure thorough ventilation. Tommasi-

Crudeli ("Climate of Rome and Roman Campagna," '92).

Valerianate of quinine as a prophylactic tried under strict surveillance in markedly malarious region. Of 30 soldiers 23 given the drug regularly; the 7 untreated suffered from fever, those treated remained entirely free. L. Cendero (Bol. de Méd. Naval, Aug., '95).

Conclusions of a recent treatise on prophylaxis of malaria are: 1. To administer quinine in preventive doses, 12 to 15 grains, at intervals of four or five days, is considered sufficient. 2. As the germs are in the atmosphere and are breathed into the lungs, troops must be commanded to keep their mouths shut when marching, as breathing air filtered through the nose is much less dangerous. 3. Malarial districts, marshes, etc., must be avoided and habitations located 200 to 300 metres above them where possible. No work should be permitted in the heat of the day. Houses should be surrounded with trees at least their own height, and windows should be glazed to keep out the evening dew. Exposure to this dew must be strictly avoided as far as possible. 4. Europeans must not attempt to cultivate the ground in the intertropical regions. It is death to them, but does not injure negroes or other natives, who should be secured for this purpose. Maurel (Bull. Acad. de Méd., Jan. 21, '96).

Prophylactic measures adopted in Central Africa: Certain amount of credit given to the exhibition of small daily doses of quinine, commenced at sea before entering the country and continued whenever the line of march lay along the course of low-banked rivers or cut across marshes or alluvial plains at a watershed-foot. The doses about 4 grains *per diem*, and were never pushed to the causation of symptoms. In Central Africa it was found after experience that the best clinical results were obtained by apportioning to each individual such an amount of the drug as sufficed to produce in him an aural disturbance indicative of the commencement of quininism. S. K. Smith (Lancet, Apr. 10, '97).

Quinine usually proves very potent in

preventing or at least mitigating malarial disease, even in very unhealthy localities. Three to 4½ grains a day can be employed for months with impunity. The daily dose should not exceed 9 grains nor be less than 2 grains. Hydrochloride preferable to the sulphate and is better supported. If added to coffee, that precipitates a portion of the quinine. Laveran (Med. Record, Oct. 2, '97).

Review of the literature of the last twelve years, including the observations of explorers, army-surgeons, and others:

The following prophylactic measures, carried out simultaneously, are necessary in malarial districts to insure adequate protection:—

1. To avoid contamination through the respired air and inoculation by insects:—

Unacclimatized men, white or black, should not be employed for the digging of trenches, the erection of defenses, or any other kind of work involving upturning of the soil. Natives should alone be utilized for this work.

High ground should be selected for camp-sites, windward, if possible, of any swamp, pool, stream, etc., that may be in the neighborhood.

The men should sleep as high above the ground as possible (not less than two feet and, if practicable, from twelve to fifteen feet) and be provided with mosquito-netting.

While crossing malaria-laden forests, glens, lowlands, swamps, etc., the men should be ordered to avoid talking.

2. To avoid contamination by water:—

When water from malarial regions is alone available for drinking-purposes, it should be filtered, or, preferably, sterilized by boiling.

Bathing should not be permitted when water from a malarial region can alone be obtained, but washing of the body with such water is permissible, provided carbolic-acid soap be employed.

3. To prevent the development of malarial parasites in the blood:—

Four grains of hydrochlorate of quinine should be administered morning and evening *during* meals as prophylactic, beginning two days before the malarious region is reached.

4. To conserve the general powers of resistance of the economy:—

Regular and frequent periods of rest should intersperse long marches. Drenching and wading through streams should be avoided when possible. Varied and adequate food should be furnished.

The head should be so protected as to secure a maximum amount of coolness under all degrees of temperature, a head-gear such as the solar tepé being furnished for this purpose. C. E. de M. Sajous (Monthly Cyclo. of Pract. Med., May, '98).

As a protection against mosquitoes a piece of oak-punk about an inch square should be placed at bed-time in a saucer on a metal plate. Upon this is to be put a large pinch, about as big as a nut, of powdered pyrethrum, and when the mosquitoes get troublesome the punk should be ignited. The smoke produced by the burning pyrethrum will infallibly drive away the mosquitoes for the night. Editorial (Gaz. Hebdom. de Méd. et de Chir., June 23, '98).

Prophylaxis against tropical malarial fever in our camps should consist of changing the clothes before retiring at night, avoidance of constipation, and a daily ration of quinine, to which whisky should be added when the subject has been exposed to rain. Sleeping in shacks or in tents with the sides open, and as far as possible selecting for camps high sites exposed to wind and sunshine should be encouraged. Hammocks should be swung at least three feet from the ground; in more permanent locations beds constructed of split limbs of trees are better than hammocks. Mosquito-nettings should always be used; and, as the mosquito of the tropics is often smaller than his fellow of the North, a very fine mesh is indispensable. To these precautions should be added a careful, systematic medical supervision of water-supplies, kitchens, and diet; a daily inspection of each company by a medical officer; and, finally, rejection at recruiting-stations of men with positive histories of malarial infection, and the invaliding home of all patients who respond only temporarily to treatment. J. E. Stubbett (Med. News, July 30, '98).

The reputed prophylactic action of quinine is but a phase of its therapeutic action; it is the application of the drug to the parasite, and not an immunizing of the body against the entrance of the parasite, one has to deal with; therefore one may confidently expect that, if it will cure a malarial infection, it will prevent its development: the development though, not the introduction of the germ. Patrick Manson (Brit. Med. Jour., Sept. 1, 1900).

The Health Department should have all malarial cases reported; every house should be thoroughly inspected and the inmates instructed to kill all the anophelines in the house; to provide the windows and doors with screens; to use every precaution to isolate the patient from mosquitoes, and to cause all the standing water in the vicinity to be drained or heavily treated to petroleum. W. H. Berkeley (Med. Record, Jan. 26, 1901).

Euchinin as a prophylactic against malaria, recommended by Celli, tried in doses varying from 4 to 8 grains per day, according to age, and continued some five months preceding the malaria season. Out of 42 persons dwelling in a malarial district treated in this manner, 5 suffered from mild fever, while of 47 unprotected 39 were attacked. Mori (Centralb. f. Bakt., June 10, 1901).

Experiment by the Liverpool School of Tropical Medicine for a reduction of mosquitoes in Freetown, West Africa. Men were hired and divided into two gangs: a small gang of six men (called the *Culex* gang), to collect from private houses all the broken bottles and buckets, empty tins, old calabashes, and similar unconsidered vessels, in which mosquitoes of the genera *Stegomyia* and *Culex* breed; and a larger gang (called the *Anopheles* gang), to drain the pools and puddles in the streets and the backyards of the houses, in which *Anopheles* breed.

On September 17th there was no doubt that the number of mosquitoes (*Anopheles*) in the streets dealt with was reduced; the number of pots and tins removed having made a considerable diminution in the *Culex*, meaning

also *Stegomyia*. On September 28th the mosquitoes were still on the decline, and in the protected streets it was already exceedingly difficult to find *Anopheles*. Taylor ("First Progress Report of the Campaign against Mosquitoes in Sierra Leone," Sept., 1901).

Attention to the following simple rules will usually suffice to prevent malarial infection:—

1. Avoidance of fatigue and excesses of all kinds. Judicious, liberal diet. The use of alcoholic beverages in small quantities, particularly in warm countries; spices and condiments in small quantities; coffee, on account of its tonic properties.

2. The drinking-water should be boiled and filtered carefully unless its purity is unquestionable.

3. Avoidance of exposure at night, which is the time the *Anopheles* usually bite. The protection of the dwelling-house from mosquitoes by the use of fine wire or other screens. The destruction of those mosquitoes which have gained entrance into the house. The screening of beds at night.

4. The destruction of mosquitoes by the draining of stagnant holes, pools, drains, and other breeding-places, and the destruction of the larvæ by the use of petroleum thrown on the surface of those pools which cannot be drained. One ounce of petroleum to fifteen square feet will destroy the larvæ, and continue to prevent their development from two to four weeks.

5. The isolation of the malarial patient from *Anopheles*, should it exist in the same locality.

Even without the auxiliary action of quinine the system carries on a more or less successful warfare against the plasmodium of malaria. In this combat the leucocytes appear to play an important rôle. Those suffering from debilitating diseases are usually more susceptible, and are wont to suffer from many relapses. Tonic treatment is, therefore, indicated, and iron in some form should be administered.

Sometimes it will be necessary to stimulate the hepatic function by the use of cholagogues. Extractum belæ

fructus liquidum is an excellent remedy for the enteric complications of malarial infection. C. C. Beling (New York Med. Jour., Dec. 7, 1902).

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MALE FERN.—Male fern (*aspidium*, U. S. P.) is the rhizome of *Dryopteris filix mas* and of *Dryopteris marginalis* (nat. order *Filices*), ferns which are found in almost all parts of the globe, especially so the former; the latter is indigenous to North America. The rhizome, which deteriorates on keeping, has a sweetish-bitter, astringent taste, and a slight odor. It contains an active principle, filicic acid; a fixed oil, a volatile oil, resin, tannin, etc. The ethereal extract deposits a yellowish-white, granular, crystalline substance (filicic acid), upon which the medicinal activity depends. The oleoresin is a thick, dark-brown fluid, of a bitter and nauseous taste; on standing, it deposits its active constituent, and must, therefore, be thoroughly mixed before being dispensed.

Preparations and Doses.—*Aspidium* (powdered crude drug), $\frac{1}{2}$ to $1\frac{1}{2}$ drachms.

Oleoresina aspidii, $\frac{1}{2}$ to 1 drachm.

Physiological Action.—The physiological effects of male fern are usually attributed to an amorphous acid, filicic acid; but the oleoresin is thought to contain all the virtues of the drug. Filicic acid first causes excitement of the nervous system, then paralysis of the latter, of the muscular system, and of the heart in the frog. This is mainly due to its depressing effects upon the spinal centres. In man its effects are probably similar, judging from the symptoms, following the injection of an over-

dose, mainly marked gastro-intestinal irritation, weakness, vertigo, tremors, cramps, amaurosis, stupor, and coma. Male fern is a vermifuge, *i.e.*, it expels the tape-worm, the entozoön against which it is generally employed.

Poisoning by Male Fern.—Toxic doses of the ethereal extract, or oleoresin, cause irritation of the gastro-intestinal tract, vomiting, purging, and great pain in the abdomen. If absorbed, it acts on the central nervous system and causes cramps in the extremities, giddiness, amaurosis, paralysis, collapse, coma, and death. Albuminuria and glycosuria are occasionally produced by overdoses of male fern. Poulssen, Katamaya, and Okamoto have found that castor-oil and other fixed oils increase the rapidity of absorption of the active principle. They should not, therefore, be used with, or after, filix mas. Six drachms have proved fatal in one adult, 12 drachms in another, and 2 drachms in a child 5 $\frac{1}{2}$ years old.

Study of the influence of male fern upon the blood and tissues of rabbits. There was a preliminary examination of each animal for several days, in order to determine the normal number of red cells, the proportion of hæmoglobin, and the weight of the body. The drug was administered through a sound passed into the œsophagus. As soon as the animal died the autopsy was performed, and fragments of the liver, spleen, bone-marrow, kidneys, and occasionally of the heart and central nervous system were hardened and subsequently sectioned. Of the eight animals experimented on, some were poisoned acutely with large doses, and others gradually with frequent small doses. In the acute cases the animals frequently died, and examination of their bodies failed to reveal any change that accounted for death. In the more chronic cases, considerable change in the constitution of the blood was not infrequently observed. This usually consisted in a diminution in the number of red cells and in the proportion of hæmoglobin, although the animals had lost a consider-

able portion of liquid, and consequently the blood was thickened. Morphological changes were not present. The glandular organs, the lungs, the heart, and the nervous system were apparently normal. The liver, the spleen, the bone-marrow, and occasionally the kidneys often contained a considerable excess of iron-pigment. The author is convinced that the liver is the organ in which the red cells are destroyed, and that the pigment deposited in it is subsequently conveyed by the circulation to the other organs. In his own observations, the granules of hæmosiderin appeared in the liver invariably one or two days earlier than in the spleen. The accumulation of the pigment in the liver does not appear to indicate that the liver-cells are incapable of getting rid of it, particularly on account of its extensive metastasis. Icterus did not occur in any case, and there was no reason to believe that, aside from the increased activity of the liver-cells caused by their participation in the destruction of the erythrocytes, there was any injurious influence exerted upon the organ. Georgiewsky (*Phila. Med. Jour.*, iii, p. 83, '98).

The poisonous symptoms liable to be produced by the liquid extract of male fern are due, as its anthelmintic action is also, to its active principle: filicic acid. To avoid these effects, the dose should be kept about 30 grains at most, and no castor-oil or other oil should be given about the same time, owing to filicic acid being soluble in it. The usual method of emptying the bowel and withholding food tends to favor absorption of the drug, and consequently its poisonous effects. No preliminary treatment, except, perhaps, a mild saline, is necessary, followed by coffee. One hundred cases treated in this manner proved successful. Grawitz (*Münchener med. Woch.*, Sept. 19, '99).

Treatment of Poisoning by Male Fern.

—The poison should be removed by evacuants, avoiding the use of castor or other oils. Stimulants by mouth and by hypodermic injection are useful to combat depression and collapse.

Therapeutics. — **TAPE-WORM.** — Male fern is used almost exclusively as a remedy against tape-worm. It is seldom

or never given in the crude form, or powder, but in the form of the oleoresin, or ethereal extract (non-official). The oleoresin, being nauseous in taste, is given best in capsules; it can be given in milk or gum-water, but is not as readily retained. A milk diet having been adhered to for a day or two, a purgative is given, followed by the oleoresin of male fern, and that in turn is followed by another purgative. The oleoresin given in divided doses, an hour apart, acts better in some cases.

ECZEMA.—Lanara has used male fern as an application in eczema:—

℞ Extract of male fern, alcoholic,
 7 $\frac{1}{2}$ drachms.
 Alcohol, $\frac{1}{2}$ ounce.
 Extract of myrrh,
 Extract of opium, of each, 1
 drachm.—M.

CYSTICERCUS.—Feletti has observed improvement in several cases of cysticercus disease following the use of the ethereal extract of male fern, more especially when the lesions were in the subcutaneous or muscular tissues.

MALT.—Malt is prepared from the seed of barley (*Hordeum distichum*, order *Graminacæ*) by the process of artificial germination and subsequent desiccation. The barley-grains are soaked in water until soft. The water is then drained off and the grain is placed in suitable receptacles and subjected to an elevated temperature for several days. It is then placed in heaps, in a darkened room, where it is allowed to germinate until the plumule has grown to be half as long as the seed. The germination is then checked by the application of heat, which is maintained until it is perfectly dry, when it has become what is known as malt. If the last heat be a low one pale or amber malt results; if dark malt is

desired the heat applied is higher and the malt may be almost roasted. The former varieties are used in medicine, the latter for making porter and dark beers. Malt has a sweet taste and an agreeable odor. In the process of malting the albumins are softened and made more spongy, the starch is changed by the action of the vegetable diastase, resident in the grain, with dextrin and maltose (malt-sugar).

Diastase, or maltine, is closely allied to ptyalin and to pancreatin. Their action upon starch is similar, if not identical. Raw starch is very slowly acted upon. On cooked starch it first produces a liquefying action, afterward converting it into dextrin and later into maltose. These ferments act best in a neutral medium. Its action is slow in an alkaline medium and is inhibited or even destroyed by the presence of an acid.

Malt is used by brewers to make beer, ale, and porter, and by distillers to make spirits. Malt enters into the combination of many foods designed for infants and invalids, of which Liebig's is the type, either with or without the addition of milk.

Malt is usually employed in the form of the extract, which is made by mixing the malt with water at a moderate heat (under 160° F.). The mixture is left until all the starchy matter has been changed into dextrin and maltose, when it is evaporated in vacuum-pans to the consistency of thick honey. If the water is entirely extracted in the vacuum-apparatus, dry extract of malt is obtained, which is the form used in the preparation of foods for invalids and children. Another form of liquid malt (so-called diastasic extract of malt) is prepared by macerating well-malted barley in warm water for several hours; the infusion is

then simmered with fresh hops at a temperature under 160° F., to retain the diastase and other albuminoids unimpaired, and then subjected to fermentation. The resultant liquid contains alcohol from a trace up to 10 per cent. It resembles porter or brown-stout in taste and appearance.

The ordinary extract of malt, resembling honey, is a good vehicle for cod-liver-oil, forming with it an excellent emulsion. It also serves as a vehicle for iron, quinine, the hypophosphites, pepsin, cascara, peptones, etc.

Physiological Action.—The claims that malt is a valuable reconstructive and digestant, though to a degree sustained by clinical observation, are not accounted for by what is thought to be its behavior in the stomach. The observations of Chittenden and Cummins would tend to demonstrate that the diastase—a ferment, formed during the germination of malt acid, is capable of converting nearly two thousand parts of starch into dextrin and glucose—is destroyed by the gastric juice. It must, therefore, be inert when the duodenum is reached. Again, the secretions being alkaline, any diastase not affected by the gastric juice would be hampered here, since it is known to act imperfectly in an alkaline medium. A neutral solution is required to obtain its best effects. That its physiological effects are still practically unknown is apparent.

Therapeutics.—Malt is a food-element, since it contains all the nutritive substances of malted barley and the ferment diastase which aids in the digestion of starchy foods. It is of pleasant taste and can be taken alone, on bread, or in milk. It may also be taken as a food in the form of an emulsion with an equal quantity of codliver-oil. It is useful in the wasting diseases, especially in marasmus

and tuberculosis. Extract of malt is often retained when codliver-oil is not tolerated.

MAMMARY GLAND, DISEASES OF.

—Under this heading will be considered the following subjects: Excessive secretion of milk, inflammatory disorders of the nipples, mastitis, and galactoceles. Tumors of the breast will be reviewed under TUMORS.

AGALACTIA, or insufficiency of milk-secretion, has been treated under that head in the first volume.

Galactorrhœa.—Galactorrhœa, or excessive secretion of milk, cannot be considered as a pathological condition, except when it is exhausting the strength of the patient, or when the profuse production of milk continues long after lactation has been suspended. The normal production in health approximates three pints in the twenty-four hours. Instances have been reported in which as much as seven quarts were secreted daily (de Mussy). It is evident that such a degree of hypersecretion need not be reached before marked emaciation, anæmia, and even hectic symptoms appear. This is especially apt to be the case when loss of appetite attends the case—not an unusual feature.

Treatment.—The active production of milk should be as much as possible arrested, but not too suddenly. In mild cases suckling should be gradually abandoned, the infant being increasingly nourished with artificial foods, and tonics be administered to the patient. In the meantime the breasts should be supported by means of bandages.

Overfilling of the glands is treated by restricted liquid diet, gentle saline laxatives, and firm compression by bandages over lower third of breasts. In caring for the breasts, patient's bowels should be kept open from the second day by

small, repeated doses of compound licorice-powder, or pil. rhei comp. The nipple is washed in warm water before and after nursing and smeared with castor-oil. If the nipple becomes chapped or excoriated, the cracks are touched with 10-per-cent. nitrate-of-silver solution once a day. C. M. Wilson (*Times and Register*, Dec. 20, '91).

As soon as the child can be weaned, iodide of potassium can be employed in increasing doses, beginning with 5 grains three times a day.

Effect of iodide of potassium tested on nursing women. From six observations it was found that the coming of the milk after labor is not delayed, that the course of the lactation is not interfered with, and that the infant does not suffer. G. Fieux (*Rev. Obstét. Internat.*, May 1, '97).

Belladonna plasters so cut as to form shallow cones leaving an opening for the nipple are then applied over each breast, the latter being still supported with bandages. Belladonna ointment can be used instead if the glands are sensitive. As a tonic Mariani's coca-wine can advantageously be employed, a wineglassful being given between meals. Cocaine and mint have also been recommended, but the danger of cocaine habit should always be borne in mind.

Antipyrine renders marked service in arresting the secretion of milk in newly-delivered women, provided the kidneys are normal. The drug is administered in 4-grain capsules, every two hours, for two days, or until 60 grains have been taken,—a quantity sufficient usually to produce the desired effect. Guibert (*Lyon Méd.*, Aug. 9, '91).

Conclusions in regard to antipyrine in puerperal women are as follow:—

1. Antipyrine can be readily discovered in the milk.

2. Given in two doses of 15 grains each, at two-hour intervals, it was discovered in the milk five, six, and eight hours after ingestion, and in some cases as long as eighteen hours.

3. The drug was found to be excreted

very slowly, and was always in very small amount in the milk.

4. It had no influence on the quality of milk.

5. It had no effect on the secretion of milk.

6. The infants showed no symptoms while the mothers were taking antipyrine, and they also rapidly gained weight.

It is certainly justifiable to use antipyrine in nursing women, more especially since it is of undoubted value in checking after-pains. Fieux (*Archiv. Clin. de Bordeaux*, Oct., '97).

When the accumulation of milk cannot be rapidly curtailed it should be drawn by means of a breast-reliever.

Disorders of the Nipples.—Although apparently trivial, these disorders are often the cause of great suffering to nursing women, and therefore merit attention.

DEFECTS OF DEVELOPMENT.—Short, depressed, and otherwise imperfectly-developed nipples—generally the result of corset-pressure—are frequently the seat of inflammatory disorders during a period of lactation and should be carefully watched.

Out of 525 in childbed only one-half could suckle thoroughly in the first two weeks. The development of the nipple bore a direct relation to the value of the breast as a secretory organ. Wiedow (*Centralb. f. Gynäk.*, No. 29, '95).

The undue suction to which they are necessarily submitted, the delicacy of the tissues, any abnormal condition of the milk, the augmented flow of saliva which the increased efforts of the infants induce, all tend to start a folliculitis. This soon develops into ulcerative fissures that become excruciatingly painful. They bleed easily and may cause, through the suffering induced, general and even mental disorders quite out of proportion to their cause. Small abscesses may follow and greatly compromise the value of the

nipple: an efficient portion of the apparatus of lactation.

Treatment.—These complications should be anticipated. Some time before parturition the nipples should be manipulated daily, the aim being to bring blood to them and to increase their nutrition by gentle efforts to encourage their protrusion. Buccal or instrumental suction is recommended by many accoucheurs. They should be washed daily with a weak boric-acid solution and carefully dried. The manipulation gradually accustoms the nipples to mechanical irritation and by the time the infant is born they are better able to stand that involved in the suckling process.

Free use of alcohol as a wash for the nipples during the last month of pregnancy recommended. In case a fissure should develop a nipple-shield should be used, and if it persist the fissure should be thoroughly cauterized. Auvard (*L'Union Méd.*, July 19, '88).

Depressed and useless nipples have been operated upon as follows:—

An assistant, with a pair of vulsella forceps, seizes the nipple and drags it out to a length somewhat greater than natural; the operator, with a pair of curved scissors, beginning, at a point about $\frac{1}{3}$ inch from the apex, excises a diamond-shaped piece of skin, extending out on the breast about $2\frac{1}{2}$ inches and about $\frac{1}{2}$ to $\frac{3}{4}$ inch broad at its centre. The fat is cleaned away down to the fascia, which protects the ducts from injury. Three such areas of denudation are made. Beginning in the denuded area, a catgut suture is passed in and out through the fascia, purse-string fashion, emerging at the point of entrance and encircling the base of the newly-designed nipple. This is now tied snugly, and, if properly passed, will hold the nipple out well after the vulsella has been removed. The denuded areas are now covered (as is the catgut suture and its knot) by drawing the skin of the diamond-shaped incision together with silk. A dressing is then applied so as to keep the breasts as much

at rest as possible, when union by first intention is usually found to have occurred. Treatment must not cease with the withdrawal of the sutures, but the nipples must be protected by a suitable shield. Axford (*Annals of Surg.*, Apr., '89).

Following method has proved successful in prevention of sore nipples:—

R Lanolin (Liebrieck), 1 ounce.

Dispense in glass or porcelain screw-cap jar.

Sig.: For external use every night.

Patient begins its use from four to six weeks before the expected date of confinement and continues until delivery. Every night at bed-time a small portion of lanolin is thoroughly worked into each nipple with the thumb and fingers. In the morning it is removed by a soft nail-brush which is well-soaked. The nipple should be brushed with lukewarm water and any mild, pure soap (preferably a white soap), giving it a thorough lathering for three or four minutes. It should afterward be rinsed with fresh water and dried as after ordinary bathing. J. Milton Mabbott (*N. Y. Med. Jour.*, Sept. 10, '98).

Instrument for stimulating and irritating the mammae employed with benefit. It consists of a large hollow hemisphere inclosing the entire breast, with an aspirating bulb. Every morning the instrument is applied and the breast aspirated. As soon as pain is felt the aspiration is stopped and the apparatus is left in place for twenty or thirty minutes.

This treatment is used in the following four classes of cases: (1) undeveloped breasts; (2) obstinate vomiting of pregnancy; (3) debility in young girls at the period of puberty; and (4) chlorosis. Dumas (*Jour. de Méd. de Paris*, 19, vi, '98).

ULCERATION OF THE NIPPLE.—Erythema frequently occurs as a complication of lactation particularly in primiparae. Far more distressing, however, is a condition due to the fact that the colostrum causes maceration of the epithelium of the nipple; small vesicles appear which, if not arrested by timely treat-

ment, generally rupture. The erosions thus formed become covered with scabs, under which healing would normally occur; but, sucking being continued, the erosions are transformed into ulcerating fissures, which sometimes involve quite deep destruction of tissue. Occasionally the small vesicles, instead of being separated, become confluent, and, the entire epithelial covering of the nipple being compromised, a raspberry-like nipple results. These conditions are sometimes greatly aggravated by an unhealthy condition of the infant's mouth—which should always receive considerable attention when mammary disorders are present.

Fissures of the nipple are exceedingly painful, as already stated. They are most frequently met with at the apex and the base of nipple, where it meets the areola. In the latter case the suction of the child tends to tear them open, as it wears; hence the excruciating suffering induced. They usually appear the fourth day, but sometimes earlier, and quite marked febrile symptoms may be induced.

Treatment.—It is evident that the prevention here, first, of the primary irritation, and, if this is present, of the secondary manifestations, are indicated. Scrupulous cleanliness of the nipple will prevent accumulation of colostrum and the primary erosions; hence this should be insisted upon. Both nipples should be carefully washed with a weak boric-acid solution, not only after nursing, but immediately before, and they should be carefully dried.

[Great care must be taken during lactation to keep the child's mouth clean and the nipple carefully washed with some antiseptic. Should there be any evidence of a threatening mastitis nursing should cease at once. W. L. RICHARDSON, Assoc. Ed., Annual, '89.]

When local lesions exist, suspension of lactation on the affected side causes them to disappear in a few days, provided adequate cleanliness is insured. When but one nipple is involved, therefore, it can be allowed to rest, the other being used for suckling. A breast-pump may be used to draw the milk from the disordered breast to avoid undue accumulation of milk. Buccal suction, by the nurse or the husband, was formerly recommended; but, the condition of the mouth being unknown, the breast-pump is to be preferred—if kept very clean.

Simple erosions usually yield promptly to hot water and laudanum, or Goulard's extract, the nipple being kept covered with a light compress soaked in either of these solutions. At night carbolized ointment is preferable, to avoid adhesion of compress to the hard surfaces when the liquid has evaporated.

Excoriations of the nipple occasioned by nursing should be painted over by a solution of gutta-percha in chloroform. This application covers the excoriations with a film, which is not removed by the application of the child to the breast. Monti (*Les Nouv. Rem.*, No. 4, '88).

Dermatol mixed with an equal quantity of castor-oil used in treatment of sore nipples. It is not necessary that the breast be thoroughly cleansed before the child receives its nourishment. P. Grossman (*Omaha Clinic*, Oct., '91).

The slight erosion on the upper surface of the nipple, so common in primiparous nursing women, heals readily when touched with a strong solution of nitrate of silver, while the fissures and cracks at the base of the nipple improve at once when collodion or compound tincture of benzoin is applied, and a glass nipple-shield used for a day or so, or, in the bad cases, suspension of nursing on the afflicted breast for twenty-four hours. The women should be instructed to notify the physician as soon as one of these lesions of the nipples appears, so that active treatment may begin at once. When pus has once reached the glandular

tissue, incision and drainage are necessary. Harrison D. Jenks (Physician and Surgeon, Nov., 1900).

Eczema of the nipples is sometimes taken for simple erosions, but it yields to the same measures. The salicylic-acid ointment is also of value.

When fissures are present, the same measures are indicated, but in addition stimulation by means of nitrate of silver is required. The nipple being washed and carefully dried, the mitigated stick, finely pointed, is gently applied to each fissure; the moisture within the latter affords precisely that needed to obtain the best effects from the remedy. Care should be taken not to touch the surface of the nipple.

In the treatment of fissured nipple, when the cracks are at all extensive, excellent results can be secured by the application of an ointment made up of equal parts of castor-oil and subnitrate of bismuth. Before application, the nipple and surrounding skin should be carefully cleansed and disinfected, and then the ointment should be smeared on plentifully. If it is necessary for the child to nurse from the affected nipple, it can be allowed to do so without the necessity of removing the ointment from the nipple.

For engorgement and pain in the mammary gland itself, which often accompanies fissured nipple, excellent results obtained from the use of an application of lead-water and laudanum, which is applied by means of a cloth covering the whole breast, renewed at frequent intervals and kept in place by a suitable mammary binder. If the child can be nursed from the other breast alone it is safer to draw the milk from the affected gland by means of a breast-pump until the cure is almost complete. If it is necessary that the child should nurse from the cracked nipple, a glass nipple-shield with a rubber tip must be employed. B. C. Hirst (Univ. Med. Mag., Mar., '91).

Orthoform dressings successfully used in fissured breasts. The technique of the dressing is very simple. The powdered orthoform is dusted over the entire wound, and the latter is covered with a

compress bearing a layer of the remedy. Over this is placed a layer of absorbent cotton, and finally rubber sheeting, the whole being kept in place by a bandage. In a few minutes the patient who has up to then felt incessant pains at the affected part, experiences considerable relief. Every time before nursing the child, the dressing is removed, the breast washed with warm boric-acid water, dried, and then the child put to the breast. At the first sucking some pains are felt, but these rapidly subside, and after the nursing is over, the breast is again washed with boric-acid water, dried, and the same orthoform dressing applied. The analgesic effect of the orthoform being very durable, it suffices to renew the dressing at first twice daily, then, as the wound begins to cicatrize and the pains disappear, once only per day.

Besides its analgesic effect, orthoform exercises in the wound an action at once siccative and antiseptic, which favors cicatrization. In 29 cases personally treated, the cure was brought about in from four to five days on the average, the patients continuing to nurse the children. This method of treatment possesses the great advantage of being innocuous to both mother and child, because the orthoform is entirely free from any toxic property. Teisseire (Sem. Méd., xviii, p. cccxvi).

In fissure of the nipple painting the nipple three or four times daily with a solution of permanganate of potassium, 2 to 5 per cent., causes the fissures to disappear in less than a week. Considerable smarting is caused at first, but this soon disappears. Before nursing the breasts should be washed with warm sterilized water, and a compress covered with a permeable cloth applied. Dombrowski (Le Progrès Méd., Jan. 7, '99).

Orthoform in saturated alcoholic solution procures anæsthesia and complete relief from pains. The solution is placed on a compress over the fissure in the nipple and allowed to remain for fifteen minutes. M. Oui (Gaz. Hebdom. de Méd., etc., June 3, 1900).

When both nipples are affected, the infant should be given the breast as

early as practicable, *i.e.*, as long as the mother can stand the pressure of the secretion. Prior to each nursing the nipple should be carefully washed and a nipple-shield employed to protect it. The infant sometimes shows evidence of ill-humor and refuses to suck through them; but a little patience usually controls the situation. A glass shield with an India-rubber tip is to be preferred. It should be kept scrupulously clean and washed immediately before and after using. If the infant refuses to use the tip, wetting the latter with sweetened water generally acts as an inducement. The remedial measures already indicated are then resorted to.

Mastitis.—Three forms of inflammation of the mammary gland are recognized: the *subcutaneous*, the *submammary*, and the *parenchymatous*.

SUBCUTANEOUS INFLAMMATION.—This form is not frequently met with, and, though it may present itself in various parts of the organ, it usually confines itself to the areola. Its development is that of an ordinary boil; the spot first becomes red, warm, and extremely sensitive. When located in the areola, several small boil-like projections usually present themselves, which seldom do not proceed to the stage of suppuration. They sometimes assume an erysipelatous character.

SUBMAMMARY ABSCESS.—The space between the gland proper and the pectoral muscle over which it lies is finished with a pad-like layer of connective tissue. Occasionally this becomes the seat of an abscess, and, when the suppuration is extensive, the breast is raised and may be moved from side to side. The local symptoms differ entirely from those of the former condition. There is but little redness, but the tissues at the base of the organs are œdematous, and the

neighboring glands are generally enlarged and painful to the touch. There is a deep-seated, dull pain, radiating to the arm and often increased by the motions of the latter. There is marked fever, especially when the pus has formed, and lasting until the latter is evacuated. Pus usually points not far from the axilla, and when the abscess opens of its own accord a fistula may ensue. It may point in the direction of the lacteal ducts, a puriform fluid then being secreted with the milk.

PARENCHYMATOUS ABSCESS.—It was formerly believed that impediment to the escape of milk, through obstruction at the nipple, by stagnant milk, epithelium, etc., gave rise to this condition, but modern researches have shown that all forms of mammary abscess are of microbic origin. Micro-organisms originating from the infant's mouth or from hands contaminated with lochial discharge infect the nipple and readily reach the deeper parts directly or through the lymphatics.

Although tubercle in the human subject is so frequently met with in young married women, tubercular mammitis is extremely rare. S. Woodhead (*Lancet*, July 14, '88).

Case of patient of slightly tuberculous aspect who, on absenting herself from her infant seven and a half hours, found that her milk was horribly foetid,—like rotten eggs. It made her feel ill, and her relatives could not stay in the same room with her. Yet the infant sucked with avidity; it was violently sick, however. Next day the milk was sweet, and the child and the mother were quite well. The breasts showed no sign of hardness, engorgement, etc. The nipples were healthy. On several previous occasions she had noticed that when she delayed giving the child the breast at the usual times the milk became foetid. Jorissenne (*Archives de Tocol.*, Feb., '91).

Case of mammary abscess which developed from infection from a lochial pad,

which the patient took from the vulva and applied to the breast as a protection from cold. Tarnier (*Jour. des Sages-femmes*, Oct. 1, '91).

In most carefully-kept wards there are septic germs which do not attain sufficient virulence to occasion serious puerperal accidents, but are capable of causing slight temporary febrile disturbances. Rémy (*Revue Méd. de l'Est.*, Nov. 1, '94).

Verification of assertion previously made by Genoud, Etlinger, and others, that in the majority of cases the milk of perfectly-healthy nurses contained staphylococcus albus, which explains the ease with which local abscesses may be produced by pressure. Charrin (*Revue des Sci. Méd. en France et à l'Etranger*, Apr. 15, '95).

Six cases of mastitis in one ward of the Strasburg Maternity, all occurring within seventeen days. In the pus from the second case there were found the staphylococcus pyogenes albus and the micrococcus tetragenus. This patient infected the third, fifth, and sixth cases, and as there was no direct contact, the infection must have been carried in the air. These women all infected their infants secondarily with aphthous stomatitis. The buccal secretion showed, along with leptothrix and streptococci, the staphylococcus pyogenes albus. A mouse inoculated therewith died in two days, and in its organs the staphylococcus was found. In the fourth case, a phthisical primipara, the mastitis was probably tubercular in nature, although no tubercle bacilli were found in the pus. In all the cases an abscess formed, and was treated surgically with success. H. W. Freund (*Centralb. f. Gynäk.*, No. 41, '96).

Infective germs which gain access to the milk do so simply by circulating through the glands in the blood-stream. In order to enter the milk they must pass through the glandular substance of the breast through some injury to the gland-substance. Bach and Weliminsky (*Berliner klin. Woch.*, No. 45, '97).

Breasts of 100 pregnant women, 137 puerperæ, and 60 children carefully examined, with the following results:—

In the majority of cases the secretions of the breast in pregnant and puerperal

women and even in the newborn contain bacteria. In pregnant women this was true in 86 per cent. of patients examined, in puerperal women in 91 per cent., and in newborn infants in 75 per cent. With very few exceptions these germs were staphylococci, and especially the staphylococcus albus. In these cases no point of entry of these germs was found nor any circumstances explaining their presence. They must have entered from without through the nipples, and especially from the areola about the nipples. The presence of these germs was harmless to mother and child. The infection in mastitis comes from without, through a lesion in the skin communicating with the lymph-channels, and spreads itself in different ways in the case of different germs. The ordinary form of mastitis results from invasion of staphylococci, especially the staphylococcus aureus. The less common forms of mastitis, such as pseudo-erysipelas and retromammary abscess, are caused by streptococci. Mastitis caused by metastatic infection through the blood-current has not as yet been clearly proved. Köstlin (*Archiv f. Gynäk.*, B. 53, H. 2, '97).

When tender the nipples should be painted with a mixture composed of equal parts of glyceride of tannin and alcohol for several days. If fissures develop, they had best be treated by tinctura benzoini compositus. If symptoms of abscess appear, all the milk should be drawn off and the parts thoroughly massaged. If the symptoms are not now relieved, the breasts should be rubbed with an ointment composed of camphor, opium, atropine, and lanolin. The bowels should be freely evacuated. Barksdale (*Charlestown Med. Jour.*, Sept., 1901).

The first sign is the presence of a hard mass in the tissues of the organ. At first no suffering is experienced, but pain is finally noticed while the infant is suckling. The presence of an abscess now becomes manifest. The hard mass previously noticed becomes very sensitive, the overlying skin red, resistant, hot, and oedematous, and the organ, as

a whole, becomes heavy. The skin over the abscess finally becomes purplish and less tense, and fluctuation is soon obtained. When several foci of inflammation are present, they may suppurate successively, and the series of abscesses thus developed may destroy the entire gland, and the sufferings of the patient continue months. Septicæmia and gangrene sometimes complicate such cases. Even in the comparatively benign cases generally met with the general symptoms are sometimes quite marked.

PATHOLOGY.—In parenchymatous inflammation, according to Bumm, who carefully studied the question, the rapid proliferation of micro-organisms in the gland-structures causes fermentation of the milk, and transformation of its sugar into lactic and butyric acids. The casein becoming coagulated, the glandular structures become engorged with the coagula, and inflammatory changes soon follow. The periglandular tissues become infiltrated with bacteria and leucocytes, while the epithelial cells lining the glandular structures swell, desquamate, and disappear. Purulent miliary foci soon form in great numbers, and adjacent foci unite. Irregular cavities are thus formed and crossed by shreds of partially-destroyed tissues. In the walls of these cavities leucocytes accumulate, which stop the progress of the microbes, preventing farther spreading of the disintegrating process.

TREATMENT.—The treatment of subcutaneous inflammation does not always vary from that indicated for the nipple. When, notwithstanding preventive measures, the abscesses are formed, the pus must be evacuated. An important point in this connection is that any incision made should invariably radiate from the nipple,—*i.e.*, cutting away from the latter, toward the periphery of the breast,

as the spokes of a wheel radiate from the hub. The milk-ducts are thus avoided, and a free incision can be made without danger, if it is necessary.

In submammary abscess the gland projects outward and seems to rest upon a pillow of fluid. The quantity of pus is sometimes very great,—over a pint,—the connective tissue yielding on all sides to form a large cavity or pocket. When the abscess does not point in any special direction, the presence of pus may be determined by means of an aspirator-needle inserted at the base, as if the organ were to be pierced. An incision can then be made near the lower border of the gland—the incision likewise radiating from the nipple. The pus being fully evacuated with antiseptic precautions, the abscess should be washed out with a 3-per-cent. solution of carbolic acid and drained with iodoform gauze.

Method in treatment of abscess is as follows: As soon as elasticity and deep fluctuation are evident, an incision is made radiating from the nipple just large enough to admit the index finger of the operator, and this is deepened until pus flows. The finger is now passed into the cavity and it will be brought fairly near the surface in a dependent position, and this is generally at the thoracic mammary junction. Sometimes the finger passes toward the axillary margin, and occasionally the cavity is so large that a stout bent probe must be used to indicate the deepest part of the abscess. In this situation, the gland being well raised by an assistant, a free opening is to be made, large enough to well evacuate the pus, and, the finger being now introduced through this, the inferior opening, the operator will find that the pus has burrowed about and is contained in loculi bounded by fibrous septa.

The cavity is well flushed out with an antiseptic solution, and a full-sized tube is introduced from below (this must be confined by a silk thread). The opening made near the nipple is closed with fine horsehair and painted with collodion.

The tube, a large one, can be left in the cavity as long as is needful, and is slowly shortened and withdrawn. The wound heals with a larger scar, but this is completely hidden by the position and volume of the gland above. Shields (*Lancet*; *Boston Med. and Surg. Jour.*, June 11, '96).

In parenchymatous inflammation the infant must be weaned, otherwise the lesions will proceed from bad to worse. To avoid suffering due to milk-production the milk-pump should be used. In the early stage the abscesses can sometimes be stopped by the application of cold compresses constantly renewed. The old treatment is now discarded. It is important to support and immobilize the breast by means of bandages evenly applied.

Inflammation of nipple and breast should be regarded as a progressive rather than a self-limited disease, arising in most instances from septic infection of the nipple. Bandaging advisable after mastitis, still-birth, and whenever weaning is necessary on account of mammary disorders. Harris (*Annals of Gyn. and Ped.*, Aug., '95).

Seventeen cases of mastitis treated successfully by evacuation of the breast, partly by sucking and partly by a sort of massage by which the breast is compressed and gently rubbed in the direction of the nipple. Kaarsberg (*Hosp.-tid.*, p. 573, '95).

Abortive treatment of threatened abscess consists in placing the cathode at some distant indifferent point and applying the anode as directly as possible to the seat of trouble. The current should be from 5 to 10 milliamperes, and may be continued from three to five minutes. The anode should be large enough to almost cover the affected area. Applications may be made daily. Should, however, the abscess be already formed, the cathode is applied locally for its electrolytic effect, and the current must be a strong one, especially in old abscesses with a well-defined limiting wall. From 100 to 200 milliamperes are required. The cathode may usually consist of a

metal stem or rod lodged within the abscess. A. H. P. Leuf (*Med. Council*, Sept., '97).

Expression used in treatment of threatened abscess of the breast. Compression should be made daily from the circumference; in a few days the induration will subside. In no case has the method failed. W. B. Warde (*Lancet*, Jan. 3, '98).

Belladonna ointment, lead-water, and laudanum are recommended by various clinicians. Saline cathartics are useful as derivatives, provided the patient is not too weak.

When the presence of pus is ascertained, it should be evacuated under strict antiseptic precautions, an incision one-half inch in length, radiating from the nipple, being made in the most dependent portion of the organ. The cavity is then washed out with an antiseptic solution and drained.

When a local anæsthetic is used, one is not apt to open an abscess as thoroughly as he would otherwise, and the abscess is likely to extend more deeply and widely than might be foretold by examination before operating. General anæsthesia should, therefore, be employed. F. H. Field (*N. Y. Med. Jour.*, Dec. 8, 1900).

The general health requires considerable attention, the strength of the patient bearing considerably upon the recovery. Good food, tonics, and pure air are important adjuvants.

Galactocèle.—This condition is due to the distension or rupture of one or more lactiferous tubes. In the latter case the milk flows within the connective tissue of the gland.

SYMPTOMS.—Two varieties of the rather rare condition are met with: in the one the accumulation of milk, within the duct or the connective tissue, occurs near the nipple and superficially. The appearance is typical, more or less large knob-like projections or swelling form-

ing the apex of the gland. It usually appears suddenly while suckling the infant, when rupture of the tube occurs without causing much local distress. In simple dilatation the growth is gradual.

The second variety occurs in the substance of the organ, forming one or more irregular lobular projections, that are quite firm under pressure, especially in cases of long standing. In the latter, when due to rupture of the ducts, the accumulated secretion is often found hemmed in by a protective cyst-wall. When the duct is simply dilated, the wall is formed by the lactiferous tube itself. The former likewise appears more or less suddenly. In some cases the gland becomes very large, and as much as five quarts of milk have been withdrawn by means of the trocar.

TREATMENT.—Aspiration is sometimes sufficient to cure small cysts; but, in the majority of cases, it is best to open the distension antiseptically and to drain.

MANGANESE. — Manganese (manganum) is a very hard brittle metal, having a metallic lustre, and a whitish-gray, metallic fracture. In the metallic state it is not used in medicine.

Manganese dioxide (peroxide or binoxide), or black oxide of manganese (mangani dioxidum, U. S. P.), is found native, containing at least 66 per cent. of pure dioxide. It occurs as a heavy, black powder, and is soluble in hot mineral acids. Dose, 2 to 15 grains.

Manganese sulphate (mangani sulphas, U. S. P.) occurs in transparent pale-rose effervescent prisms having a bitterish, astringent taste, and is soluble in 0.8 parts of water. Dose, 5 to 15 grains.

Potassium permanganate (potassii permanganas, U. S. P.) occurs in dark-purple, slender, opaque prisms, having a blue; metallic reflection, and a sweet,

with astringent after-taste, and is soluble in 16 parts of cold water and 3 parts of boiling water. Permanganate of potash is incompatible with all oxidizable substances, particularly organic ones. Dose, $\frac{1}{2}$ to 3 grains.

The liquor ferri mangani peptonate (non-official) is very generally used. Dose, 1 to 4 drachms.

Physiological Action. — The physiological action of manganese is not established. Once thought to be a chalybeate equal to iron, it failed to sustain the reputation, and is rarely employed by the profession in the treatment of anæmia and chlorosis. Especially has it been ostracized since Gahn demonstrated that there was considerable doubt as to whether it entered the circulation at all, while there was nothing to show that it was taken up by the blood-corpuscles.

Poisoning by Manganese. — **ACUTE POISONING.**—In toxic doses manganese causes intense gastro-enteric inflammation and death by convulsions. In smaller doses it lowers the action of the heart, diminishes the pulse-rate, and lessens the blood-pressure.

CHRONIC POISONING. — Absorbed in large doses and for a considerable period it acts as a cumulative poison, induces acute fatty degeneration of the liver, a progressive wasting and feebleness, a staggering gait, and paralysis (paraplegia). This latter variety is the one seen among the miners of the metal.

Therapeutics. — **MENSTRUAL DISORDERS.**—Manganese dioxide has been used extensively in the treatment of disorders of the uterine functions, especially when due to a functional cause. It has been used in membranous dysmenorrhœa in doses of 2 grains, in pill or capsule, given four or five times daily. In amenorrhœa, of acute suppression of the menses from cold, and when the menstrual discharge

is scanty and irregular, manganese is of good service.

Some 200 cases treated with permanganate of potash. It was found of service in dysmenorrhœa in otherwise healthy girls, in excessive subinvolution after childbirth, in atrophy during puerperal affections, and in pelvic peritonitis after labor. The remedy proved of little avail in affections of the tubes and ovaries in which the gonococcus was found, and in atrophic conditions of the uterus from early appearance of the menopause. Lvoff (Med. News, May 19, '88).

Binoxide of manganese used for many years for functional derangements of the uterus with a smaller percentage of failures than from any other drug.

In the absence of organic disease it seems to have the power, in a great many cases, of bringing the menstrual function back to the normal standard in whatever direction the deviation from that standard may have been.

In painful menstruation beginning about four days before the expected period, and continuing until the flow is fully established, it will generally give a measure of relief.

The headache of a burning character, and limited to the vertex, which so frequently has a uterine origin, is often promptly relieved by two or three doses of the drug, administered at intervals of two or three hours.

It also gives decided relief to the hot flashes attending the menopause, if the patient takes a pill of 2 grains at bedtime.

The dose is 2 grains three times a day, but as it is absolutely without unpleasant effects, it may be given in much larger quantity and at much shorter intervals. For its effect upon the periods it should be given for three or four days before the expected time and continued nearly or quite through the period, this being repeated for several consecutive months. A. H. Smith (Ga. Jour. of Med. and Surg., Jan., '98).

ANÆMIA AND CHLOROSIS.—In anæmia and chlorosis manganese is beneficial, but only when combined with iron. Gude's liquor mangani-ferri peptonatus

is a very palatable and efficient preparation for the purpose. It has an agreeable, astringent, but non-metallic taste, and may be given in the dose of a dessertspoonful to a tablespoonful three or four times daily, alone or in milk. This preparation increases the appetite, does not disorder digestion, and can be taken steadily for a long period.

SCROFULA.—In scrofula and debility due to prolonged suppuration the non-official syrup of the iodide of iron and manganese is a remedy of great value.

GASTRIC DISORDERS.—In gastrodynia and pyrosis, the dioxide, in doses of 10 to 15 grains, is recommended by Leared.

JAUNDICE.—Malarial jaundice has been relieved by the sulphate of manganese in doses of 2 grains. The sulphate, however, has an irritating effect on the bowel, and is unsafe.

RHEUMATISM.—The internal administration of potassium permanganate has been advised for the treatment of acute articular rheumatism, diphtheria, and diabetes. Its usefulness in the diseases is doubtful.

ANTIDOTE TO MORPHINE, PHOSPHORUS AND SNAKE-BITE.—H. William Moor, of New York, has shown that potash permanganate is a direct chemical antidote for morphine, but is without effect on atropine, cocaine, veratrine, pilocarpine, aconitine, and strychnine. An equal quantity, grain for grain, of permanganate is antidotal to morphine. In cases of poisoning by opium, laudanum, or the uncombined alkaloid, he advises acidulation of the antidotal solution with dilute sulphuric acid, or white-wine vinegar, in order that the insoluble morphine may be converted into a soluble salt. (See OPIUM.)

Hagnos, of Budapest, has found the permanganate a reliable antidote in phosphorus poisoning. After washing

out the stomach he introduces a pint of a $\frac{1}{10}$ -per-cent. solution and allows it to remain. If applied immediately after the receipt of the wound it is efficacious in snake-bite poisoning.

EXTERNAL USES.—Externally the permanganate has a wide field of usefulness. Applied as a wash or on compresses of gauze or lint, in the strength of 2 to 10 grains to the ounce of water, it is a valuable deodorizer and disinfectant for sloughing wounds, cancerous growths, ulcers, gangrene, and caries. Dilute solutions have a stimulant action on the tissues and favor granulation and healing. It may be used as a spray in ozæna or as a mouth-wash or spray in diphtheria, scarlatina, and conditions causing foul breath.

Upward of 300 cases of toothache from dental caries successfully treated by administering $\frac{1}{20}$ solution of permanganate of potash in the form of a mouth-wash. One tablespoonful was taken into the mouth every half-hour, and held on the affected side for several minutes. The agonizing pain disappeared in a few hours. Popoff (*Russkaia Med.*, No. 19, '87).

Sponging the feet with permanganate solution will remove the odor of abnormal perspiration. In purulent ophthalmia permanganate solutions (1 to 2000 or 1 to 5000) have been found useful. A 2- to 5-per-cent. solution has been used with benefit in leucorrhœa. In a 1- to 2-per-cent. solution it finds favor as an injection for gonorrhœa.

Permanganate solutions should not be injected into gunshot wounds of the abdomen, or into abscesses connected with the peritoneal cavity, as they are sometimes irritating or even caustic. Glycerin should not be added to permanganate solutions, as it is incompatible, and forms a violent explosive.

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MANIA. See **INSANITY.**

MANIA A POTU. See **ALCOHOLISM.**

MASTITIS. See **MAMMARY GLAND.**

MASTOID DISEASE. See **CEREBRAL ABSCESS, EXTERNAL EAR, and INTERNAL EAR.**

MEASLES.—From an old English word meaning a spot.

Definition.—Measles—morbilli or ru-beola—is an acute, infectious, contagious disease generally met with in children.

Symptoms.—Measles runs a less variable course, as a rule, than does scarlet fever and some other infectious diseases. Very mild cases sometimes occur, however, while the disease occasionally runs a very severe course. In rare instances a malignant type is encountered. Among 115 cases Carr found the average duration of the disease when uncomplicated to be twenty-six days from the prodromal symptoms to the end of desquamation. The period of incubation of measles is about twelve days.

Measles usually begins gradually, with feverishness, sneezing, coryza, suffusion of the eyes, and photophobia. Occasionally a chill followed by a high temperature is the initial symptom. Within twenty-four hours after the advent of the first symptoms a cough of peculiarly hard dry character appears and the attack presents all the symptoms of a catarrhal cold. The coryza, however, is more marked than that of an ordinary cold. The fever often falls somewhat after the first day; a fact which may throw the physician off his guard. The coryza and cough, however, do not correspondingly diminish with the fall of the temperature, but usually increase. The eruption appears on the side of the

face and is usually first seen on the afternoon of the fourth day and is accompanied by increased fever. The eruption may appear as early as the second day, particularly in young children, and is, in rare instances, delayed to the fifth or sixth day. Drowsiness is not uncommon during the stages of invasion, but there are no characteristic constitutional symptoms.

During the stage of invasion and before the anatomical changes are noticed on the surface of the body an eruption will be found upon the *velum palati*, which constitutes the surest sign of the affection. Tyler (*Amer. Jour. of Obstetrics*, Aug., '88).

The initial fever, or catarrhal stage, varies to an equal extent with the incubation period; out of 193 cases in which this was noted, 12 had no premonitory symptoms, the rash being the first sign of illness; 41 were affected only one day, 29 two days, 55 three days, 35 four days, and 21 from five days to a week before the eruption appeared. In one case there was a period of three days of giddiness, with a subnormal temperature, followed by a measles-rash. J. G. Carstairs (*Australian Med. Jour.*, July 15, '93).

Measles give rise to a mild pultaceous-erythematous stomatitis: this may precede exanthem, always accompanies it, and disappears with it. It is insidious and latent, and serves as means of diagnosis in doubtful cases (measles or rubella). Comby (*Le Bull. Méd.*, Nov. 24, '95).

Measles may have a premonitory rash. These eruptions vary in character, being scarlatiniform, morbilliform, and erysipelatous. They may even resemble red miliaria. The erythemata generally appear about the second day of the period of invasion, and disappear before the measles eruption. Robet (*Jour. de Méd.*, Sept. 10, '96).

Premonitory symptoms. A notable loss of weight occurs in many cases (Henri Meunier, 1898) in children in apparent health. It begins on the third, fourth, or fifth day of incubation, and continues for six or seven days, with a

normal temperature. A second sign consists in a great increase in the number of leucocytes, a day or two previous to any catarrh or other premonitory symptoms. During the period of eruption the number of leucocytes falls very greatly below the normal. Combe suggests that the micro-organism of measles should be searched for during the period of hyperleucocytosis. Koplik's spots are not nearly so important an indication as an erythemato-pultaceous stomatitis of the cheeks and gums (Comby), which consists of redness and swelling of the mucous membrane of the gums and inside of the cheeks, which are covered with a pale, opalescent, easily detached, whitish, epithelial coating. It precedes the eruption very often, and is then a trustworthy premonitory sign. While all these signs have a certain diagnostic value, none of them can be absolutely relied upon. Guinon (*Rev. Mens. des Mal. de l'Enf.*, Apr., 1901).

Epidemic of measles in which a pultaceous angina developed from two to seven days before the measles in 15 cases out of 100 seen. Small, white, isolated, bluish-white spots also appeared on the roof of the palate with Koplik's sign, fever, and dysphagia. In some of the cases diphtheria bacilli were found in the throats. Saint-Philippe (*Jour. de Méd. de Bordeaux*, Apr. 7, 1901).

Koplik has recently described a symptom which he believes to be of great value in making an early diagnosis of measles. On the first day of invasion he has found that an examination of the buccal mucous membrane in a good light will reveal a scattered eruption consisting of small, irregular spots of bright-red color, in the centre of each of which is a minute bluish-white speck. This he regarded as pathognomonic of measles. Carr and other writers have recently expressed a belief in this symptom.

Diagnostic importance of the bluish-white spots upon the mucosa of the cheeks, signalized by Koplik as a constant phenomenon of the period of in-

cubation, confirmed by the examination of 50 morbillous patients. Libman (*Med. Rec.*, June 11, '98).

Koplik's sign noted in all of 65 cases of measles in which it had been looked for in the early stages. Looked for in coryza, tonsillitis, bronchitis, r  theln, antitoxin rashes, erythema multiforme, urticaria, scarlet fever, pityriasis, eczema, scabies, and impetigo, it was invariably absent. Sobel (*Med. Record*, June 3, '99).

The most important signs during the invasion period are: 1. Stomatitis, accompanied by patches of pultaceous exudation, which is almost constant. It may also appear in scarlet fever, but is not to be found in German measles. 2. Characteristic spotting of the palate may be seen one or two days before the rash. 3. Koplik's spots, which are present in 95 per cent. of cases at a period three days before the eruption. Cazal (*Gaz. des H  pitaux*, Aug. 22, '99).

Extensive experience in measles has shown that the presence of Koplik's spots is absolutely pathognomonic of measles, just as much so as the existence of the malarial plasmodium in the blood is indicative of malaria. Before the appearance of the eruption great care is necessary in looking for these spots, because they occur from five days to a few hours before the cutaneous manifestations. There is a time, sooner or later in every case of measles, in which these spots are present. Many cases which have been diagnosed as measles without Koplik's spots are believed to have been nothing more than cases of German measles. This is particularly true of the severe form of German measles. German measles is a disease separate and distinct from true measles, and this fact is emphasized by the absence of Koplik's spots. In this affection there is a disproportion between the cutaneous manifestations and the constitutional symptoms. Failure to see Koplik's spots in measles may be due to the fact that before the physician's visit they had been washed off. These spots can hardly be seen by artificial light, they require an abundance of good daylight, and the cheek should be everted. Jacob Sobel (*Pediatrics*, Mar. 1, 1900).

Filatow described spots in 1895 and Koplik in 1896. The latter states that they are bluish white, but they really appear as fine white specks, easily removed by rubbing. After they have persisted for a short time they are surrounded by a red areola. The buccal mucous membrane is their commonest site, opposite the lower or upper molars on either side, and often upon the inner surface of the lower lip and the inner surface of the upper lip. They were noted in all of personal cases. Most observers will probably agree with Filatow in considering them to be white. In size these spots are often quite minute, and require a strong illumination for their recognition; at other times they are three, or possibly five, times as large, and are then very readily distinguished even with the reflected light of an oil lamp. On rubbing the spots with the handle of a teaspoon it will be found that the white substance of which they are composed is not at all easily removed. Around each spot is a red areola. On the first day of their appearance the red areola may, however, occasionally be absent, and it will then be very difficult, if not impossible, to make a confident diagnosis. These little spots consist of papill   the epithelium of whose summits has become pulpy and whitened, while the papilla itself and the area of mucosa immediately surrounding it have become hyper  mic and slightly swollen, so that one gets the appearance of the white speck surrounded by the red areola. Certain observers have erroneously described them as vesicles. In cases in which this exanthem is very abundant the individual specks may lie in such close apposition that the white substance of contiguous specks may coalesce, thereby forming spots of a size unusual for Filatow's spots, and raising in one's mind a suspicion that they may be due to some form of stomatitis other than the kind in question. Filatow's spots when they disappear generally do so with great rapidity. They are often present in moderate abundance on the one day and entirely absent on the next. L. Falkner (*Lancet*, Feb. 2, 1901).

The value of Koplik's spots studied two years at the Children's Hospital, Budapest. During 1899 and 1900 the mouth of every child in the out-patients' room was examined for them. Over 30,000 patients passed through the department in that time, and in no other disease but measles was the sign found to be present; 348 of these patients were suffering from measles, and in all but 19 the spots were present; 57 out of 144 in-patients with measles showed Koplik's spots on admission, and developed a rash on the skin in from one to five days later on. The others had the skin eruption already out; of these, 8 were without the sign, but then the eruption had been out for two days or more. Lorand (*Jahrbuch f. Kinderh.*, June, 1901).

Koplik spots were present in 81 per cent., and an initial eruption on the hard palate in 86 per cent. It was only possible to observe 12 cases during the period of incubation; in these the spots were found seven times on the first day of the disease, when the temperature began to rise, when the eruption on the hard palate usually did not show itself before the third day. O. Müller (*Münch. med. Wochen.*, Jan. 9, 1904).

The temperature will occasionally be found at 103° or 104° on the first day, but it is usually not above 102°. The fever does not ordinarily range as high in measles as in scarlet fever. Not infrequently after a sharp rise on the first day the temperature falls on the two following days, but increases as the eruption appears and reaches its height on the second day of the eruption. From that time it gradually falls, and becomes normal between the seventh and ninth days of the disease. Not infrequently there is a sudden fall on the sixth or seventh day, forming almost a crisis. The fall of the temperature after the initial rise on the first day is sometimes so decided as to lead to error in diagnosis. The possibility of such a fall is always to be considered. The fever and other constitu-

tional symptoms are usually at their height when the eruption has reached its fullest development on the fifth or sixth day of the disease.

Case of a child of 16 months who developed a temperature of 107° F. during the premonitory symptoms of measles. Four days later the temperature suddenly rose to 110° F. Stimulation with the application of a modified cold pack brought the temperature down to 97° in three-quarters of an hour; convulsions followed, occurring several times during the next 12 hours; subsequently, the condition improved and the child gradually recovered. R. H. A. Hunter (*Brit. Med. Jour.*, Apr. 30, '98).

The rash usually appears on the afternoon of the fourth day, but in some cases is seen on the third day and in others is delayed until the fifth day. It is first seen on the temples and sides of the face, on the neck, or behind the ears. When it first appears it commonly consists of small red spots having no strictly characteristic appearance. They rapidly increase in size and form small macules or very slightly elevated papules on a slightly-reddened base with normal skin between. They are circular or crescentic in shape, and, being hyperæmic in nature, disappear on pressure.

As the eruption develops it tends to become confluent in places, particularly on the face, where it assumes a blotched appearance. There is usually a certain amount of œdema, particularly about the cheeks and eyes, which farther tends to change the appearance of the patient. The eruption usually reaches its height at its first site of appearance at the end of thirty-six hours; it remains stationary for about two days, and then rapidly fades away. It extends over the body somewhat slowly, appearing on the trunk and limbs on the second day.

The wrists and backs of the hands are commonly the points to be last involved.

When at its height in these places, the rash is sometimes partially faded on the face and neck. On the first day the spots form simple macules, but later they become flat papules that can be readily felt by the finger and are sometimes almost shotty to the touch. The rash commonly presents its most typical appearance on the chest.

The typical rash of measles is frequently accompanied by miliary vesicles and in rare cases petechiæ appear. Occasionally the rash, instead of assuming the usually hyperæmic form, becomes distinctly hæmorrhagic. This may occur in limited areas or may extend over the whole body. In the latter case it presents the type known as "black measles," a condition extremely rare in private practice. It indicates a severe form of the disease, but is not as generally fatal as is popularly supposed. The spread of the eruption is sometimes extremely rapid, the whole body being covered in a few hours, but this is rare. In other rare instances the rash is so slight and of such short duration as to be almost overlooked. The constitutional symptoms in such cases are, as a rule, correspondingly mild. Occasionally in malignant cases, marked by sudden and severe initial symptoms, the rash scarcely makes its appearance or is greatly delayed.

Enanthem described as characteristic of German measles. This is a macular, distinctly rose-red eruption upon the velum of the palate, the uvula, extending to but not on to the hard palate. These spots are arranged irregularly, not crescentically, are the size of large pin-heads, and are very little elevated above the level of the mucous membrane. It is very short lived and fades away within the first twenty-four hours. It is the same eruption found upon the skin. Forchheimer (*Pediatrics*, July 1, '98).

Clinical observation of measles and scarlet fever in hospital and private practice has led the author to the con-

clusion that the temperature curve in these two acute infectious diseases is as characteristic and distinct for each of them, as are the respective curves of typhoid, typhus, and small-pox. In measles the temperature rises in steps, irregularly, to about the sixth day, then falls by crisis on the seventh or eighth day. In scarlet fever the rise to the maximum temperature occurs on the first day. The temperature stays at the maximum until about the sixth day, when it falls by lysis, reaching normal between the tenth and thirteenth days. H. W. Berg (*Medical Record*, July 2, 1904).

The constitutional symptoms reach their height during the stage of eruption, being usually at a maximum on the sixth day of the disease. They then remain stationary for about two days, when the fever abates and all the symptoms begin to subside. This sometimes occurs so suddenly on the sixth or seventh day as to form a crisis. This, however, is not the rule.

During the height of the disease the patient presents a very characteristic appearance. The face is covered by a patchy eruption and is swelled and œdematous; the eyes are red and sensitive to the light and are filled with a mucus or muco-purulent secretion; the nose is swelled and discharges a similar secretion; there is a dry, metallic, and very troublesome cough; the tongue is coated; the appetite is completely lost; the bowels are frequently relaxed; the child lies in a heavy and stupid condition, but is restless and irritable when disturbed. The glands at the angle of the jaw are frequently enlarged, and not infrequently the post-cervical glands, also.

As the fever subsides the cough rapidly changes its character, becoming looser and less irritating. It frequently disappears within a week, but sometimes the evidences of bronchitis continue, and the

cough proves a troublesome symptom for several weeks. In most cases the photophobia subsides rapidly, but the eyes are prone to remain weak and watery. If strong light is admitted too soon a mild, but very troublesome and persistent, form of conjunctivitis may result. Other symptoms usually subside rapidly; the child becomes brighter and less irritable; the appetite returns, and evidences of illness soon disappear.

During the incubation there is a decided hyperleucocytosis of the neutrophile polynuclear leucocytes. This is followed during the exanthem by a very marked hypoleucocytosis of these same elements, which, in certain cases, is accompanied by lymphocytosis at the same time that one finds a general adenopathy of the lymphatic ganglia. After the exanthem the number of leucocytes, if the case is uncomplicated, returns to normal. Plantenga (Arch. de Méd. des Enfants, vol. vi, p. 129, 1903).

DESQUAMATION.—Desquamation begins as soon as the eruption has faded, and follows the order of its appearance. It rarely continues more than ten days in any given area, and may be of much shorter duration. It is most intense where the eruption has been most intense. It occurs in fine branny scales quite unlike the lamellar desquamation of scarlet fever. It is often so slight as to be completely overlooked, particularly when inunctions of the skin have been carefully used. Desquamation is usually completed in from twenty to twenty-four days after the onset of the disease.

Irregular Forms.—Measles is capable of assuming very irregular and atypical forms. Such irregular types are most common in children under three years. Nevertheless, in a given number of cases a much larger proportion of measles cases will run a typical or regular course than will a similar number of cases of scarlet fever.

In an epidemic of 423 cases, only 123 were of the regular type; 103 were of the malignant type, complicated with some other disease, and furnished 7 of the fatal cases. The remaining 200 cases were of the hæmorrhagic form. The only symptoms present in absolutely all the cases, of whatever type, were rise of temperature and eruption. The catarrhal symptoms were entirely absent in about 5 per cent. of the cases. The mouth-rashes of Guersant and Blache and of Girard were present in only about 25 per cent. C. J. Edgar (Canada Med. Record, Dec., '92).

MILD TYPE.—The disease may be extremely mild, the eruption being faint, the fever slight, and all the symptoms mild. Such cases present no variation from the usual type except that of mildness in degree. Although the catarrhal symptoms may be slight, the diagnosis of *morbilli sine catarrho* should be made with extreme hesitation.

Case of a girl who had measles for the first time at eight years, and a second attack two years later.

In the first attack the skin was severely affected, but the catarrhal symptoms were extremely mild. In the second attack the throat symptoms were severe and characteristic, but the exanthem did not appear until two or perhaps three days after the usual time, as indicated by the other symptoms, was imperfectly developed, and soon faded. Gottstein (Münch. med. Woch., No. 13, '96).

During last winter and spring very severe epidemics of pertussis and measles were witnessed, in White County, Tenn. The whooping-cough made its appearance a few weeks previous to the outbreak of measles. Four aggravated cases of pertussis contracted measles, and not one of the four had a symptom of pertussis after the measles eruption was well developed, and all made an uneventful recovery from both diseases. The children (aged from two to four years) had from fifteen to twenty paroxysms per day. Two of the cases had hæmorrhages from the mouth with al-

most every paroxysm. H. B. Young (Med. News, Mar. 2, 1901).

During two and one-half years 150 patients were treated at the South Department of the Boston City Hospital who had measles and diphtheria. Of these, 34 per cent. died. The earlier in the course of measles that diphtheria develops, the more serious is the prognosis. The existence of diphtheria or the possibility of its onset should be considered in every case of measles. The congestion of the mucous membrane of the air-passages caused by measles renders it especially fertile for the growth of the diphtheria organism. D. N. Blakely and F. G. Burrows (Boston Med. and Surg. Jour., July 25, 1901).

SEVERE TYPE.—A severe form is sometimes seen, marked by unusually high temperature, intense eruption, and severity of all the symptoms. Except in young children, the uncomplicated disease, even when of severe type, is rarely fatal. But it should not be forgotten that a temperature that reaches an unusually high point or continues unabated as the eruption fades is usually due to some complication, commonly pulmonary. Any marked variation from the usual type demands particular attention, for it commonly indicates a complication.

MALIGNANT TYPE.—Malignant measles, marked by intense and overwhelming symptoms from the outset, is fortunately rare outside of institutions. The same is true of hæmorrhagic, or black, measles.

Rubeola tropica is a specific eruptive fever, the primary rose-red rash appearing on the face and neck on the second day of the illness; the second rash, miliary and papular, on the body, face, and occasionally on the limbs, on the fourth day. The third rash—of small, coalescent wheals—appears on the arms and legs, or legs only, on the sixth day, when the fever subsides. The more severe form of the disease chiefly attacks adults. It is epidemic, contagious, but seldom associated with catarrh or des-

quamation, and characterized by the intensity of the pains in the back, head, and orbit, on the third and fourth days of the illness. The period of incubation is, in ascertained cases, under seven days. For three days after the disappearance of the rash the patient can eat but little, and is so weak that he feels disinclined to attempt to walk. Soreness is experienced in the back and sides, but the headache and pain in the orbit are gone, although giddiness is complained of. A marked symptom in all is complete absence of taste. A further sequel is a subcutaneous hæmorrhage from the capillaries of the legs. James Cantlie (Lancet, June 25, '92).

Case of malignant measles in an adult, simulating typhus fever, purpura fulminans, cerebro-spinal fever, and variola. J. C. Wilson (N. Y. Med. Jour., Aug. 4, '94).

RELAPSE in measles is extremely rare and is, in fact, of doubtful occurrence. A secondary rise in temperature after a normal fall indicates a complication.

Eleven cases of measles with relapses were seen in two epidemics at about the same time. From the two series of cases it would appear that overcrowding was more probably the cause of relapse than increased virulence of the germ. A. Chauffard and G. H. Lemoine (Bull. Méd., Jan. 1, 8, '96).

Two clear cases of recurrence in measles seen. Sévestre (Bull. Méd., Jan. 1, 8, '96).

Of more than 700 cases of measles, not a single case of recurrence or relapse seen. Comby (Bull. Méd., Jan. 1, 8, '96).

Etiology.—Measles is doubtless due to bacterial action, but no specific micro-organism has yet been isolated.

Bacillus considered the specific organism of measles discovered in fourteen cases of the disease, in the blood as well as in the sputum, and the nasal and conjunctival secretions.

It is very variable in size, sometimes as long as one-half the diameter of a red blood-corpuscle, sometimes quite small, with the appearance of diplococci. Canon and Pielicke (Brit. Med. Jour., Apr. 23, '92).

Blood in 24 severe cases of measles examined according to the method detailed by Canon and Pielicke, with entirely negative results. Albert Josias (*La Méd. Mod.*, June 2, '92).

Bacillus personally observed as existing in the blood in measles. The bacilli in the blood vary in length from one-half micromillimetre to the diameter of a red blood-corpuscle, and in cultures grow into long threads. They stain well with all the aniline dyes, and in the longer forms a part of the protoplasm often remains unstained. They lose their stain by Gram's method. They grow best in bouillon or sterile serous fluid from the abdominal cavity, in which a whitish, fairly heavy sediment is formed, which in older cultures becomes yellowish-gray. The cultures have no characteristic odor. Rabbits were always immune to the bacteria. Mice died from septicæmia three to four days after inoculation with small quantities of the culture, the bacilli being obtained again in pure cultures from the liver and spleen.

The bacillus believed to be the specific cause of measles. Joseph Czajkowski (*Centralb. f. Bakt. u. Parasit.*, Nos. 17 and 18, '95).

The vitality of the germ is evidently small, though it must be extremely diffusible, for measles is the most contagious of the infectious diseases, except small-pox.

Persistence of the infectious germs of measles: Four children in the same family having had measles, their clothes, the bedding, and apartments were carefully disinfected. A fifth child, born 13 months later, was wrapped, at birth, in one of the blankets which had been used during the outbreak of measles, but which had been stored away during the interval. On the tenth day the infant developed typical measles, from which it recovered. J. H. Adams (*Archives of Pediatrics*, July, '99).

The virulence of the micro-organism is thought to be transient. It is important to note that the contagion of measles does not lose its virulence as quickly as has been supposed, and that death does not proceed from the attack

itself, but almost always from one of the complications of the disease, of which broncho-pneumonia is the most common. This latter complication is due to the presence of the streptococcus, and it is this micro-organism that makes the admission of a patient, even with a mild attack of measles, into the ward of a children's hospital dangerous, as this micro-organism is most formidable in this disease when the respiratory mucous membranes have lost their protective ciliated epithelium. Vallin (*Sem. Méd.*, Feb. 21, 1900).

Its occurrence is uncommon under six months, but above that age every child who has not already had it may be expected to contract it upon exposure.

Case of infant born on the day when the mother exhibited the morbillary rash, and at the time of birth had nasal catarrh, conjunctivitis, and cough. When three days old the eruption was out over the whole body, the temperature was raised, and the whole clinical picture of measles was presented. Recovery occurred after the lapse of six days. A. Bartsch (*Ugeskrift for Laeger*, No. 48, '96).

Case of measles in an infant, eruption appearing thirteen days after delivery. Possible infection at birth. Carstairs Douglas (*Brit. Med. Jour.*, May 7, '98).

Case of infant seized one week after birth with measles. Other children in the house had been suffering from the disease, and it is believed that infection occurred at birth. F. C. Fitz-Gerald (*Brit. Med. Jour.*, Oct. 1, '98).

Adults are rather more susceptible to it than to the other infectious diseases. Measles is endemic in all large towns, but at intervals it becomes epidemic and spreads over a wide area before it expends itself. Sex is not a predisposing factor.

SOURCES OF INFECTION.—Measles is transmitted by direct contact, but the area of contagion is large. Although intermediate contagion may occur, it is comparatively rare. The infectious power of the poison is quickly lost, so

that sick-rooms very soon become safe for occupancy.

The following conclusions deduced from study of three distinct epidemics of measles: 1. Measles are spread by actual contact with the *materies morbi*. 2. A case in the stage of incubation may inoculate those who are unprotected. 3. It cannot be carried by a protected person coming from a case of the disease to a susceptible person. 4. It does not spread through the atmosphere. 5. Strict quarantine will prevent it. V. M. Reichard (Therap. Gaz., July 16, '88).

Following conclusions bear on the incubation and contagiousness of measles: 1. The germ of rubeola does not remain in a locality from which those who have suffered from the disease have gone away. Hence, disinfection of the bed and furniture is unnecessary. 2. Contagion is always direct, from person to person. 3. Incubation is shorter in the intense than in the mild forms. It usually lasts from 12 to 18 days, but may last 21 days. 4. The power of the contagion is such that in a favorable medium it attacks all who are susceptible to it. 5. Contagion is possible 3 or 4 days before an eruption is evident. 6. Broncho-pneumonia is a secondary additional infection, but may co-exist with the rubeola and manifest a mixed infection. Bard (Revue d'Hygiène et de Police Sanitaire, May 20, '91).

Letter, in which the concluding sentence read: "I am writing, holding upon my knee my little girl, who has just developed measles," was received by a woman from her sister-in-law, and it happened that she also had her daughter upon her knee while reading the letter. The child played with the envelope and carried it to her mouth. Although the letter was at once burned, the child developed measles twelve days later. H. Gripat (Archives Méd. d'Angers, No. 2, 1900).

Measles is not necessarily a mild disease; there are a greater number of individuals living in boarding-houses and lodging-houses who require hospital treatment, if ill with measles; present accommodations are insufficient; in order properly to protect scarlet-fever

patients and measles patients from cross infection, a separate pavilion is imperatively demanded for the treatment of those ill with the latter disease. J. H. McCollom (Boston Med. and Surg. Jour., Jan. 8, 1903).

It is possible that contagium may be conveyed by the breath; but it is certain that it resides in the sputa and the discharges from the nose and eyes.

The nasal fossæ and the throats of monkeys touched with mucus obtained from children with measles in the first or second day of the eruption. Three out of eight animals presented local and general symptoms resembling those seen in human measles. Josias (La Semaine Méd., Mar. 9, '98).

If the contagion resides in the desquamation scales, it is far less potent than is the poison carried by the desquamation of scarlet fever. The disease may be conveyed by clothing or it may be contracted by a susceptible person entering a room recently left by a measles patient.

INCUBATION.—The period of incubation ranges from 9 to 21 days. Holt found it to be between 11 and 14 days in 66 per cent. of 144 carefully-observed cases. I have repeatedly seen the initial symptoms appear 12 days after exposure. From all the evidence available it would seem that 12 days is the most common period of incubation.

The incubation period varies from 8 to 9 days to 15 and 16 days in different cases. Measles are extremely contagious before the rash appears. J. J. Eyre (Brit. Med. Jour., Feb. 23, '89).

Case of measles in which the period of incubation was 27 days. P. Trekaki (Paris Méd., vol. xiv, No. 49, '89).

Incubation of measles is almost uniformly thirteen or fourteen days. W. F. Lockwood (Archives of Ped., June, '93).

In several hundred cases of measles the period of incubation was found to be from twelve to eighteen days. J. G. Carstairs (The Scalpel, July 15, '93).

Infection.—Measles may be contagious from the first appearance of the catarrhal symptoms, authentic cases being recorded in which the disease was transmitted four days before the eruption appeared. It is most contagious, however, when the disease is at its height. The contagiousness diminishes as the active symptoms subside, and is slight during the stage of desquamation. Except in complicated cases, in which the catarrhal symptoms are usually prolonged, the period of infection is not over twenty-eight days.

Rubeola is very contagious during the period of invasion; continues to be so, but at a less degree, during the eruptive period; and ceases at its termination. Transmission is usually effected by the circumambient air. Contagion by a visitor or by objects which the patient touches is rare. Sevestre (*Le Prog. Méd.*, Mar. 2, '89).

Pathology.—In uncomplicated measles the lesions are confined to the skin and the mucous membranes of the conjunctivæ, nose, pharynx, larynx, and the larger bronchial tubes. The morbid changes of the skin are those of acute hyperæmia; on the mucous membranes they are those of acute catarrh. In complicated cases pseudomembranous inflammation may occur. Death rarely results from the simple disease, but rather from the complications, which will be considered later. The complications are due to mixed infection, the germ most commonly present being the staphylococcus. The streptococcus is, however, frequently present, and, as a rule, causes more serious lesions than those of the staphylococcus. The mucous membranes are rendered very susceptible by measles to these germs. As they are invariably present in the wards of hospitals, the disease in such institutions is always a dreaded one, for it is prone to be complicated.

In post-mortem examinations of patients dying from measles, a general infection by streptococci found. Le Dantec (*Gaz. Hebdom. des Sci. Méd. de Bordeaux*, June 19, '92).

Case in which a varioliform eruption developed in a case recovering from an attack of measles. An eruption having same structure as pustules of variola may occur without involvement of epidermis, but simply through presence of bacteria in the capillaries of papillary body; thrombosis of vessels of the skin may occur without hæmorrhage. Unna (*Univ. Med. Jour.*, Oct., '95).

Case of gangrene of the lung in measles. In the gangrenous focus there were found streptococci, a bacillus resembling the Klebs-Löffler bacillus, and bacilli resembling morphologically the streptothrix and a large, putrefactive germ. Méry and Lorrain (*Soc. Anat. de Paris*, Mar., '97).

The more serious complications of measles can be best explained by supposing that the measles toxin exerts its chief action on the vagus and its branches. Cioffi (*Rif. Med.*, Mar. 2, 3, 4, 5, 1900).

Complications and Sequelæ.—The most common and serious complications of measles are broncho-pneumonia, membranous laryngitis, and otitis; the most common sequelæ are tuberculosis and conjunctivitis.

Eye complications of measles include conjunctivitis, simple or muco-purulent, blepharitis, blepharospasm, hordeolum, and keratitis. D. H. Wiesner (*Medical Record*, May 17, 1902).

Bronchial catarrh is an essential part of measles, but it is very easy for the inflammation to extend from the smaller bronchi to the alveoli, thus transforming a normal condition into a most serious complication, — namely, broncho-pneumonia. The younger the child, the greater is this danger. It occurs chiefly in children under three years, and is comparatively rare in children over four years. It is very common in institu-

tions and renders measles the most dreaded of all epidemic diseases in infant hospitals, diphtheria being no exception to the rule. In a recent epidemic of measles in the Infants' Hospital of New York every case in children under eighteen months was complicated by broncho-pneumonia or croup, and 80 per cent. died. The pneumonia usually made its appearance soon after the eruption reached its height, but developed in a few cases during the stage of invasion, the disease being regarded in two instances as simple broncho-pneumonia until the eruption suddenly appeared. According to Holt, 10 per cent. of all cases are complicated by broncho-pneumonia. He agrees with Henoch that a certain amount of pneumonia is found at autopsy in almost every fatal case. Carr found it clinically twenty-one times among one hundred and fifteen hospital patients.

The pneumococcus and streptococcus are met with in the saliva of children suffering from measles with much greater frequency than is the case in health. Broncho-pulmonary complications in the course of measles only occur, with but rare exceptions, in children in whom the saliva contains the pneumococcus and streptococcus; therefore, during the progress of a case of measles the most rigorous attention should be paid to buccal antisepsis. H. Méry and P. Bouloche (*Revue Men. des Mal. de l'Enfance*, Apr., '91).

Four cases of measles complicated with muco-sanguineous diarrhœa. Children in same ward and almost simultaneously attacked; all died presenting symptoms of broncho-pneumonia. At autopsy, ulcerations of sigmoid flexure and rectum analogous to those of true dysentery. Meslay and Jolly (*Revue Men. des Mal. de l'Enfance*, Aug., '95).

Lobar pneumonia is an occasional complication of measles in children over four years, but is seldom if ever found under three years. Empyema is sometimes a

sequel of such complicating lobar pneumonia. The signs and rational symptoms of either form of pneumonia complicating measles present nothing unusual.

Case of subcutaneous emphysema complicating measles in the absence of any violent cough or any known injury. S. W. Kelley (*Therap. Gaz.*, Jan., '91).

Study of a large number of lungs at autopsy showed that the appearance differs considerably from that of ordinary broncho-pneumonia, for, though typical areas of consolidation are unmistakable, the cut surface has a peculiar ragged appearance and dilated bronchi are abundant. The lower lobes were frequently consolidated and the pleura often participated in the process, though not to a marked degree. The most important lesions are found in the walls of the bronchi, which show epithelial desquamation, swelling of the submucosa, intense congestion, and hyperactivity of the glands. C. Hart (*Deutsch. Arch. f. klin. Med.*, vol. lxxix, Nos. 1 and 2, 1904.)

Catarrhal pharyngitis is an essential part of measles; pseudomembranous pharyngitis sometimes occurs as a complication. Instead of invading the nose and ears, as in scarlet fever, it shows a strong tendency to invade the larynx; but croup frequently develops without the appearance of membrane in the pharynx.

Laryngeal cough, due to punctate spots and shallow ulcers in the air-passages, is very common in measles. The symptoms suggest croup. A. Brothers (*Jour. of Laryng.*, May, '93).

Six cases of croup with alarming stenosis, 2 cases of dyspnoea of pulmonary origin, 1 case of broncho-pneumonia with pyothorax, 3 cases of acute delirium during convalescence from measles (all three in adults), and 1 case of polyuria with retention, for twenty-two days (without paraplegia), all noted as complications of measles. H. Audéoud and M. Jaccard (*Revue Méd. de la Suisse Rom.*, Jan. 20, '94).

As in scarlet fever, the pseudomembranes which develop during the height of the attack are usually due to streptococci, and are, therefore, not true diphtheria. Those which develop later are usually due to Klebs-Loeffler bacilli and are true diphtheria. This secondary streptococcic disease, however, is quite as fatal as the bacillary disease. Not only is the child in imminent danger from laryngeal complications, but it is almost certain, also, to develop broncho-pneumonia, which occurs as the direct result of streptococcic infection. The differential diagnosis between true and false diphtheria can rarely be made with certainty from clinical appearances alone. Fortunately, in private practice both complications are rare in children over four years.

Rapidly-fatal so-called pseudodiphtheria may supervene in measles without affording any certain diagnostic clinical sign. W. F. Lockwood (*Archives of Pediatrics*, June, '93).

Klebs-Loeffler bacilli in the throats of ten out of twenty-eight cases of measles. None, save one case requiring intubation, showed any sequelæ or further manifestations of diphtheria. R. S. Adams (*Med. Rec.*, Sept. 29, '94).

Case of association of measles and diphtheria in the same subject. M. Poulet (*N. Y. Med. Jour.*, June 5, '97).

Otitis, while less common than in scarlet fever, sometimes occurs, but does not usually prove so serious. Both ears are usually involved, but the disease presents in its symptoms and course nothing worthy of particular mention.

Alterations found in the labyrinth in measles which pertain to the lymphatics and the blood-vessels. In the former the lymph coagulates and the cells accumulate; they also fill up the semicircular canals and the cochlea. The endothelium undergoes fatty degeneration. In the blood-vessels the destruction is nearly complete in the Haversian canals and in the spiral ligament. The muscles

undergo waxy degeneration. The nerves become gelatinous and, at places, entirely atrophied. The cells of Corti's membrane are also similarly degenerated. Notwithstanding the intensity of these lesions and the frequency of auditory complications in measles, permanent deafness is a rare sequence. Moos (*Amer. Jour. Med. Sci.*, July, '88).

Tympanic involvement was due in 26.1 per cent. of cases to measles. The otitis media is due, not so much to direct extension of inflammation from the throat and nose, by the Eustachian tube, to the middle ear, as by the sealing or plugging of the mouth of the Eustachian tube by the retained mucus in the naso-pharynx, the damming, then, of mucus in the ear, with consequent distension, extravasation, and pain in the ear,—all favored by the recumbent position. Downie (*Brit. Med. Jour.*, Nov. 24, '94).

The inflammatory process in the middle ear in measles usually runs its course without subjective and often without objective symptoms, and only now and then leads to spontaneous perforation of the membrana. The ears in measles should therefore be carefully watched. A. O. Pfingst (*Pediatrics*, Feb. 1, '98).

Complete anorexia is common during the febrile stage. Diarrhœa is of frequent occurrence and may be so severe as to prove a serious complication. It may be due to simple intestinal indigestion, or it may be the evidence of enterocolitis. It is occasionally so severe as to prove a serious complication.

Febrile albuminuria is not infrequent in cases with high temperature, but nephritis is very rare.

Nervous symptoms, excepting the occasional appearance of convulsions at the outset, are rare.

Paralysis following measles is more frequent in the female than the male, and more frequent in children than in adults. Bayle (*Revue de Ther. Medico-Chir.*, Mar. 1, '88).

Paralysis due to measles is not as rare as is commonly believed. There are two forms, the spinal and cerebral. P. A. Lop (*Centralb. f. klin. Med.*, No. 50, '93).

Case of ascending myelitis complicating measles. Ellison (*Lancet*, Oct. 17, '96).

Two cases of mania during measles. Finkelstein (*Wratch*, No. 20, '98).

Polyneuritis after measles has thus far only been observed in two cases, to which the writer adds a third. A girl of 16 years developed otitis media and broncho-pneumonia as sequel to measles. She also presented hyperaesthesia of the skin and tenderness on pressure along the various nerve trunks. The symptoms gradually subside and were attributed to the measles, as no other cause could be found for their appearance. E. Eden (*Berl. klin. Woch.*, Aug. 8, 1904).

Endocarditis and pericarditis are seen in rare cases.

Meningitis may occur as a further complication, through the presence of otitis.

Cellulitis and suppurative adenitis are uncommon, but moderate enlargement of the cervical glands often occurs and sometimes persists for months.

The occurrence of measles simultaneously with other infectious diseases is not very infrequent. There seems to be a particular tendency to the simultaneous occurrence of measles and pertussis.

Case of concurrent measles and scarlet fever. The germs of the measles must have been in the system of the child at the time that it developed scarlatina. C. H. Phillips (*Brit. Med. Jour.*, Dec. 20, '90).

Case of concurrent enteric fever and measles. Juhel-Renoy (*Le Bull. Méd.*, Mar. 12, '93).

Two cases of urticaria seen during the incubative stage of measles. Of 270 cases of measles, croup was present in 17 cases, and in 3 cases diphtheria. Claus (*Jahrb. f. Kinderh. u. phys. Erzieh.*, June 5, '94).

Pertussis as a complication of measles noted 21 times in 166 cases. E. P. Bernardy (*Annals of Gyn. and Ped.*, July, '94).

Case in which typhus and measles oc-

curred in a patient at the same time. J. Tenner (*Amer. Medico-Surg. Bull.*, Aug. 15, '94).

Case of measles and scarlatina co-existent in the same child at the same time. A. A. Himowich (*Med. Rec.*, Sept. 7, '95).

Case in which erysipelas co-existed with measles. Measles exerted arresting influence upon erysipelas, which, in turn, was also favorably influenced by morbid process. Janovski (*Med. Obozrenije*, vol. xlv, No. 15, '95).

Tuberculosis is the most serious sequel of measles. It commonly occurs as a tubercular broncho-pneumonia, general miliary tuberculosis, tubercular adenitis, or tubercular joint disease. These conditions may result from primary infection or from the lighting up of some old tubercular process. Measles unquestionably renders the tissues very susceptible to tubercular bacilli; so that infection may result from slight exposure. Acute miliary tuberculosis may follow measles at once, the temperature-range being continuous from the outset of the primary disease to death from the complication. General tuberculosis with grave pulmonary involvement may follow so close upon measles as to leave no appreciable interval between. It is sometimes the cause of a secondary fever, which develops soon after the subsidence of the primary fever. Tubercular disease of the bones and joints subsequent to measles is usually of late occurrence.

Case of disseminated cutaneous tuberculosis consecutive to measles. Du Castel (*Bull. de la Soc. Fran. de Derm. et de Syph.*, vi, p. 86, '95).

Tuberculosis follows measles with remarkable frequency. J. A. Larrabee (*Pediatrics*, Oct. 1, '97).

Chronic conjunctivitis is a frequent sequel of measles which may be in large degree prevented by judicious care. Iritis and keratitis are possible sequels, but are not common.

Case of bilateral ophthalmoplegia and right hemiplegia following measles. Raymond (*Gaz. Heb. de Méd. et Chir.*, Jan. 5, '96).

Prognosis.—Death from measles in private practice is rare in children over four years of age. Holt, after the study of a large number of cases, concludes that the mortality of the disease is from 4 to 6 per cent., but under two years it is often 20 per cent. or more. It is highest between one and two years, but even at this age uncomplicated measles is not a highly-fatal disease. Pneumonia is the cause of death in almost 90 per cent. of fatal cases.

A violent onset with high temperature warrants a guarded prognosis. A rising temperature with a fading eruption warrants an unfavorable prognosis. The same is true when the eruption is excessive in amount and confluent over wide areas. Grave general symptoms with faint eruption is a serious condition. The same is true of an hæmorrhagic or black eruption, but it is not as necessarily fatal as is commonly supposed.

The mortality from measles at the Hôpital Trousseau in 1895 was 14.4 per cent.; 715 children were admitted. Comby (*Lancet*, Mar. 21, '96).

The death-rate from measles during the last twenty years shows that there are two maxima, one in December and a higher one in May and June. The death-rate has diminished during the last ten years. The highest mortality is found among infants during the first year. A rickety chest with the accompanying broncho-pneumonia doubles the mortality. Möller (*Archiv f. Kinderh.*, vol. xxi, '97).

Measles has a marked tendency to leave behind it results of a serious nature. Treatment should not be directed solely to saving the life of the child nor should the prognosis be made up solely with reference to that event. The tendency to tubercular invasion should never be

forgotten, and when the fever persists after the tenth day, even if it is not high, the prognosis should be guarded. The list of chronic affections left in the wake of measles is a long one; bronchitis, pharyngitis, rhinitis, adenoid growths, enlarged tonsils, and mesenteric glands are among the number which should receive consideration.

Prophylaxis. — The advisability of taking particular precautions against the exposure of infants is suggested by the high mortality of measles before three years. Delicate children of the so-called scrofulous type and those with hereditary tendency to tuberculosis should be especially guarded against exposure. Early and absolute isolation of the sick is imperative. Quarantine of the patient should not be less than twenty-eight days and as much longer as purulent discharges may continue. The period of quarantine after exposure should not be less than fifteen days and twenty days is preferable. Children who have been exposed should be isolated from other children for that period.

The sick-room is less liable to prove dangerous than is the scarlet-fever sick-room. Thorough cleansing and ventilation for two weeks after the patient has left it is sufficient to insure safety. The infection of measles is not persistent nor is intermediate infection common; so that prolonged precautions are not necessary. During the height of the disease the same measures should be taken to avoid the exposure of others as in other infectious diseases.

Excellent influence of the closure of schools in an epidemic of measles; schools were closed for a period of four weeks, and only 4 cases appeared among 20,000 scholars after the schools were reopened. Wolford (*Sanitary Record*, May, '89).

As a prophylactic measure, the disin-

fection of the nasal fossæ, the mouth, pharynx, genitals and anus advised. J. Comby (*La Méd. Mod.*, Jan. 6, '94).

In order to avoid the broncho-pulmonary complications of measles it is necessary to realize as much as possible the asepsis of rubeolous patients and to disinfect the quarters in which such patients are cared for. Hutinel (*Méd. Infant.*, July 1, '97).

Treatment.—The patient should be placed in as large and well ventilated room as possible. The temperature should not be kept at too high a point nor should the child be forced to swelter under too heavy covering. It accomplishes no good and renders the child restless and irritable. The room should be kept very dark and no direct light should be permitted to fall upon the eyes. As the inflammation of the eyes subsides, the light should be gradually admitted, but full light should not be permitted until the conjunctivæ have become normal in appearance. Itching of the lids should be relieved by cold cloths or by the application of cold cream or some bland oil. If a purulent discharge appears the eyes should be kept clean by a frequent application of a solution of boric acid.

When troublesome pulmonary symptoms are present and severe inflammation of the eyes, fluid extract of eucalyptus, in 5-drop doses. For eyes, solution of mercuric chloride (1 to 12,000), a drop or two instilled twice daily and followed by washing with solution of borax in warm water. Wells (*Phila. Polyclinic*, July 13, '95).

The child should be put to bed, even in the mildest cases, and kept there until desquamation is practically completed. The diet should consist of milk and broth during the febrile stage; during the height of the disease the child should not be overurged to eat.

Applications of plain or carbolized vaselin do much to reduce the irritability

of the skin. As soon as the eruption begins to subside, inunctions of plain or carbolized vaselin or ichthyol ointment should be practiced daily. A daily warm bath does much to hasten desquamation.

Over three hundred personally treated, with a mortality of only four. This low rate of mortality attributed to the method of treatment invariably adopted, namely: jacket poultices, to be changed as soon as any indications of measles show themselves and before the rash appears. The only medicinal treatment adopted has been ipecacuanha-wine with acetate of ammonia, with a boric-acid wash for the eyes in those cases which were complicated by catarrhal inflammation of the lids. Stomatitis occurred in about one-half of the cases and invariably yielded to the application of a saturated solution of chlorate of potash. A. Dunley Owen (*Lancet*, June 20, '97).

If ichthyol salve can be applied in measles from the very first, it aborts the infection. If the eruption is already apparent, with hyperthermia and bronchitis, the temperature returns to normal after one or two rubbings, and the patches grow pale and disappear. In four or five days the cure is complete, when a warm bath is given to remove the traces of the salve. The salve is rubbed in all over the body, morning and night: 7 1/2 drachms of ichthyol to 3 ounces of lard. A. Strizovere (*Jour. Amer. Med. Assoc.*, Apr. 30, '98).

The hard metallic cough is one of the most troublesome symptoms of the disease. Very little relief, however, can be afforded by treatment before the fever begins to subside. It cannot be loosened by the administration of nauseating expectorants. They tend to render the child more irritable and to increase the anorexia and have but slight effect on the cough. Small doses of opium aid in allaying the cough, and are quite permissible. Brown mixture in the form of tablet triturates is as effective as any treatment and is easy of administration.

Guaiacol carbonate used in the treatment of measles. From the first the success with the remedy was marked. There was complete suppression of the respiratory troubles; so that while the patients had measles, some very severely, with temperature running between 104° and 105° F., they had nothing else, and when the temperature fell to normal they were practically well. The treatment seems to have no modifying effect on the measles itself, but it eliminates the respiratory complications. The treatment is begun when the diagnosis is made and the drug is continued in full doses until the temperature falls to normal, a reduced quantity being given for two days longer to make sure of the result. The adult dose of 10 grains every three hours is proportionately reduced in children, according to their age. It is easily administered to young children if given with an equal amount of powdered sugar. D. N. Paton (*Lancet*, Nov. 21, 1903).

Though hyperpyrexia is uncommon in measles, the fever sometimes requires attention. The effect of the fever upon the patient is a better guide for treatment than is the thermometer. If the child becomes restless or delirious, small doses of phenacetin are admissible. Only enough should be given to reduce the temperature moderately and to allay restlessness. Cold sponging is the best treatment for high temperature and is far preferable to the administration of large doses of antipyretics.

In the eruptive fevers hydrotherapy affords better means of controlling the pyrexia and the accompanying nervous phenomena than treatment by antipyretic remedies. Pulmonary congestion and broncho-pneumonia are also favorably influenced by baths, the water being gradually cooled, while cold water is poured on the head. Guinon (*Blätter f. klin. Hydrotherapie*, etc., July, '91).

Life was prolonged in two or three cases of measles by means of gavage, or forced feeding. In cases with cyanosis, high temperature, and great dyspnoea, hot mustard baths, and mustard to the

entire body seemed to be more serviceable than any other means used. L. Emmett Holt (*Brit. Med. Jour.*, Mar. 18, '93).

As a rule, hydrotherapy is unnecessary in measles, but should the following conditions arise it is useful: Should the patient be stuporous, or if there be marked delirium and convulsions, cold affusions at 60° to 70°, lasting for two minutes, may be applied to the head and neck. If this is insufficient to reduce the temperature, then a bath of 70° to 80°, lasting for five minutes, with colder affusions to the head, may be used. Should there be signs of laryngeal stenosis, it may be well to place the child in a hot bath or in a hot pack for from fifteen to twenty minutes. Should the face become very much congested, cold affusions may be applied to the head or an ice-bag may be used. Should the temperature become subnormal, a hot bath may be given accompanied by energetic rubbing. Jurgensen (*Blätter f. klin. Hydrotherapie; Therap. Gaz.*, July 15, '98).

Uncomplicated cases do not require stimulants. Broncho-pneumonia requires the same treatment that it would receive under other conditions. Other complications must be treated as they arise.

Following treatment employed in the paralysis following measles: Should paralysis depend upon simple congestion of the marrow it is to be treated with ergot, strychnia, and the galvanic current to the spine, followed by a cold douche, the faradic current being employed at the same time. This should be followed by dry friction, sulphur- and sea-baths. If the symptoms do not subside, iodide of potassium should be given in small doses. Heat may be applied to the spine or an eschar made with the thermocautery. Calomel in small doses is of service. Should respiration become difficult or the heart fail, artificial respiration and injections of ether must be used. If congestion is evident, a wet cup should be applied to the nape of the neck. In case of retention of urine a catheter must be passed two or three

times a day. Bayle (*Revue de Thér. Medico-Chir.*, Mar. 1, '88).

Medicinal treatment not considered necessary in cases which run the regular course. Alimentation is the treatment for high temperature. Suggestion of Semmola and Dujardin-Beaunetz to substitute glycerin for alcohol is a very good one. An ounce of glycerin may be given daily, combined with about 8 ounces of water and $\frac{1}{2}$ drachm of citric or tartaric acid.

Treat broncho-pulmonary complications with a combination of infusion of ipecacuanha, tincture of aconite, and syrup. When the cough is particularly rebellious, good results are obtained by giving iodide in combination with bromide of sodium. Montefusco (*Revue Mens. des Mal. de l'Enfance*, Aug., '88).

Successful stamping out of broncho-pneumonia, occurring as a complication in a hospital. Child given sublimate baths; every sore, abscess, or crust of impetigo carefully dressed; nose and fauces irrigated several times daily with boric solution or boiled water; every child affected with broncho-pneumonia promptly isolated. Hutinel (*La Méd. Mod.*, Jan. 26, '95).

Cocaine has proved a sovereign remedy in bringing out the eruption in a few hours in three cases of abnormal measles. Generally it was administered in a daily amount of 0.3 grain to children five years old. M. Poulet (*N. Y. Med. Jour.*, June 5, '97).

The treatment of measles should be directed to the prompt development of the eruption. For this purpose the iodides with diaphoretics are valuable. In cases of retarded eruption, the sheet pack wrung out of hot water in which a tablespoonful of mustard-flour has been steeped has proved effectual. The bowels, if constipated, should be relieved by enemata. The apartment in which the patient remains should be airy and well ventilated, without draughts, and with facilities for maintaining a moderate amount of darkness, and an equable temperature, night and day, of 70° F.

To develop the eruption and allay incessant laryngeal cough the following may be given:—

℞ Syrup of hydriodic acid,
Syrup of Dover,
Syrup of Tolu, of each, 1 ounce.

The Dover syrup to be lessened for infants.

During the eruptive stage and throughout a broncho-pneumonia give:—

℞ Potassium acetate, 2 drachms.
Solution of ammonium acetate,
Camphor-water, of each, 3 ounces.

A teaspoonful to be given every hour to a child, and a tablespoonful every hour to an adult. This treatment should be accompanied by the use of copious draughts of water. J. A. Larrabee (*Pediatrics*, Oct. 1, '97).

Tincture of aconite, in 1-drop doses, is serviceable in addition to spirit of Mindererus. Vomiting is best relieved by giving the stomach rest. Rectal alimentation and rectal medication should be resorted to during these intervals of rest. When the nose and the pharynx discharge freely and irritate the child, irrigation with some bland antiseptic, such as a 1-per-cent. boric-acid solution, will be useful. When the expectoration is swallowed an emetic is useful in removing the accumulated viscid secretion, if it is very annoying. Steam, impregnated with eucalyptus or oil of thyme, will be found useful when the cough is distressing. Malt extract for the relief of cough is a very favorable preparation. One of the most frequent causes of death, next to pulmonic complications, is intestinal catarrh, and, consequently, great care must be exercised in the use of purgatives. Louis Fischer (*Medical Record*, April 12, 1902).

Phlyctenular conjunctivitis with its array of dangerous complications, including ulceration of the cornea, is often witnessed in dispensaries as a sequel of measles. This is mainly due to the fact that text-books on diseases of children do not lay sufficient stress upon the importance of keeping the lids aseptic by careful cleansing, and not using the eyes for reading, writing, etc., until the system has completely recovered from the debilitating influence of the disease, in

which the ocular muscles take an active part.

Treatment in the early stages of the eye inflammation in measles is very important. For the conjunctivitis simple warm boric-acid lotion, with a little boric-acid ointment along the edges of the lids to prevent them sticking, is all-sufficient. If the tears are profuse, hot, and scalding, an alkaline lotion (bicarbonate of soda, 10 grains to the ounce) gives relief. When marginal blepharitis is present, the scabs should be diligently removed (a rather painful process) and dilute ammoniated-mercury ointment applied. The removal of the scabs will be facilitated by using a borax lotion. Ulcers must be treated in the ordinary way, cleanliness being insured by frequent boric-acid fomentations, atropine drops, and a shade over both eyes, or dark glasses may be worn. It is often best to get these children out-of-doors (provided the general condition permits), protected from the light by dark glasses. Percy Flenning (*Brit. Med. Jour.*, Apr. 29, '99).

During convalescence, unusual care should be exercised in avoiding unnecessary exposure. Tonics should be given freely. The various sequelæ should receive proper attention, and the particular susceptibility to tuberculosis should not be forgotten.

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MEDIASTINUM, DISORDERS OF THE.

Mediastinal Abscess.

Symptoms.—In an analysis of over one hundred cases Hare found that the most constant and severe symptom of mediastinal abscess was pain, unless the formation was cold abscess, when the pain was a very unimportant factor. In both the acute and chronic form flashes of heat and rigors may occur, particularly the latter in the acute forms.

Pulsation may be perceptible by palpation and by the sensation of the patient from the pressure on large blood-vessels, and the sense of pulsation is intensified by the outside pressure upon the accumulation. Abscess of the posterior spaces may, by its pressure on the nerves as they leave the cord, produce violent pain in the anterior wall of the chest. Dysphagia is not so marked as in other growths of the chest. There is a sensation of weight under the sternum, the tissues overlying the latter being frequently œdematous. Dyspnœa is occasionally complained of. General symptoms—fever, anorexia, etc.—are usually present, and become quite marked when the accumulation of pus is marked.

Case of abscess of posterior mediastinum, with cyanosis and subcutaneous emphysema; venesection; recovery by discharge through the lung.

A remarkable feature was a high degree of subcutaneous emphysema, which extended over the neck and the upper part of the chest. William Pepper (*Inter. Med. Mag.*, Feb., '92).

Case of mediastinal abscess in a soldier upon whom a heavily-laden sack had fallen while he was lying down. Some days afterward he experienced severe pain in respiration and gradually became weak and emaciated. Some eight months later he noticed a tumor the size of a hazel-nut on the right edge of the sternum above the second rib. This grew rapidly, and in a month he could only breathe when lying down, the sense of pressure being very great. An incision over the tumor brought 12 ³/₄ ounces of pus from above the sternum. The size of the incision was increased. Abundant irrigation and cauterization with zinc chloride at 10 per cent. were then employed, with tampons of iodoform gauze, but no sutures. Recovery was uneventful. Hassler (*La Sem. Méd.*, Oct. 10, '94).

Diagnosis.—The pressure on the important nerves involved the pneumogastric, the recurrent laryngeal, etc., and

the vascular trunks sometimes markedly simulate aneurism. The difficulty in breathing and the brassy sound of voice recall the symptoms of thoracic aneurisms. But the violent pain at times experienced by aneurisms is usually absent, though there may be marked discomfort.

An exact diagnosis in suppuration of the mediastinum is important, owing to the probability of rupture of an abscess into the serous cavities, terminating in pleuritis; peritonitis, pericarditis, or later septicæmia.

Etiology.—Mediastinal abscesses may be idiopathic, secondary, or traumatic. The idiopathic form is quite rare; the secondary form may result from lesions in neighboring parts,—the neck or thorax,—while the traumatic follows blows, contusions, penetrating wounds, and fracture of the overlying bones. Abscess of the mediastinum affects males more frequently than females. In Hare's cases the proportion was as 58 is to 10. The anterior mediastinum is the most common seat for its development (in the proportion of 48 to 19 instances of the disease in all the other spaces). The proportion of acute to cold abscess was also noted by Hare to be as 40 is to 31 in 111 cases examined. Mediastinal abscess is nearly as frequent as cancer; it occurred in 136 cases of the 520 growths collected. Abscess is more frequent than sarcoma, of which only 90 occurred, of the last number mentioned.

Mediastinal abscess is occasionally a symptom of Pott's disease, especially if the two lower cervical vertebræ are involved. It also occurs as a complication after tracheotomy or œsophagotomy. The most frequent cause, however, seems to be pericarditis.

Pathology.—Mediastinal abscesses are attended usually with obstruction, to a greater or less extent, of air- and blood-

channels from the pressure upon them, and are recognized by dullness on percussion over the region involved. An opening may exist, or bulging of the ribs with pulsation may occur, but such an accumulation in the mediastinal spaces may not reach the exterior surface, owing to the sternum in front and the spinal column with the heavy muscles behind, while abscess of the middle mediastinum must involve the lungs or the lateral spaces before coming into notice.

Treatment.—The only safe course in such cases is to trephine the sternum and to carefully explore the mediastinum, ascertaining with an exploratory needle whether pus is present. This is usually ascertained without trouble. The cavity should then be opened, gently washed out, and drained.

The advantage accruing from drainage in other parts is greater in mediastinal abscesses, and early incision, or resection of a rib or portion of the sternum, is not only indicated, but demanded. The urgent symptoms calling for this course may be mentioned:—

1. Dysphagia, or pressure upon the œsophagus.

2. Enlargement to the left of the sternum, and at times to the right.

3. Displacement of important organs, such as the heart or lungs.

4. Dullness and flatness of the region of the lungs.

5. Thorough drainage may be made also when the cause of trouble is a cyst or a serous collection; so that no special difference need be made.

6. Chills or hectic indicate pyæmia, and call for systemic as well as local treatment.

Mediastino-Cardiac Disorders and Injuries.

The heart is intimately associated with

almost all of the contents of the whole mediastinum, but especially the large veins and arteries, which commence or terminate, as the case may be, within the pericardium.

MEDIASTINO-PERICARDITIS is a frequent complication of mediastinal inflammation and usually terminates in serous effusion before it is fully recognized. At times the serous effusion is absorbed, as is the case in pleural effusions of a serous nature. The afebrile type of pericarditis may be fatal, however, and no effusion exist. The most serious result is suppurative pericarditis.

Treatment.—Aspiration and drainage are indicated in serous pericardial effusions. Incision and drainage should be performed for the relief of suppurative pericarditis. The site for either of these operations is that between the fourth and fifth ribs,—about one inch to the right or left of the sternum.

Pericardial effusions should be treated in the same manner as pleural effusions, paracentesis being insufficient to cure suppurative pericarditis. Incision and drainage are essential, and should be executed as soon as the diagnosis of pus in the pericardium is made. The diagnosis of the purulent character of the effusion is determinable only by exploratory puncture. This should be done at the upper part of the left xiphoid fossa, close to the top of the angle between the seventh cartilage and the xiphoid cartilage. Pericardiotomy should then be done after resection of the fourth and fifth costal cartilages, raising a trap-door of these cartilages and using the tissues of the third interspace as a hinge. The mammary vessels and pleura are thus exposed and pushed to the left. The prognosis is good after pericardiotomy for pyopericardium. Of 26 collected cases there were 10 recoveries and 16 deaths. Of the fatal cases, 9 were septic, and all the others which died had complicating lesions,—pulmonary, cardiac, or renal. J. B. Roberts (Med. News, May 8, '97).

INJURIES.—Wounds of the heart and pericardium may now be classed as other injuries of a similar kind, since Rehn has successfully sutured penetrating wounds of the heart with catgut. Rehn recommends free opening in cases of hæmothorax, and in hæmopericardium this is necessary to prevent the formation of bloody froth.

Among the rarer injuries to the contents of the mediastinum that may be mentioned is rupture of the heart, which has been demonstrated post-mortem. It may be diagnosticated by the peculiar pallor, the sudden cessation of the rhythm and beat of the heart, together with the total irresponsive condition of the circulation to all stimulants.

In 560 autopsies five deaths were found to be due to rupture of the heart. These cases are of forensic importance, as they show a comparative frequency of this condition in a certain class of cases. The youngest patient in the group was sixty-two and the oldest eighty-one. In all the cases the arteries were said to be fibrous, and in 2 almost calcareous. The pulse before the rupture varied from 72 to 120. In only 1 was irregularity noted. In 2 there was hypertrophy of the heart, in 2 it was stated to be normal, and in 1 there was a systolic murmur. In 4 cases the rupture was in the left ventricle and in 1 in the right auricle. The microscopical examination showed no changes in 2 cases; in 1 there was fatty degeneration; in another marked brown atrophy with loss of the transverse striations; and granular degeneration, cell-fragmentation, and somewhat similar microscopical findings in another case. R. L. Leak (Amer. Medicine, Sept. 6, 1902).

Mediastinal Vascular Disorders and Injuries.

DISEASES.—The diseases of the blood-vessels of the mediastinum are those found in the vascular supply of other

parts, viz.: aneurism, phlebitis, arteritis, etc. (See ANEURISM and VASCULAR SYSTEM.)

Case of aneurism of the transverse arch of the aorta that ruptured into the mediastinum and dissected along the muscles and about the pharynx and larynx, causing death. There was marked lividity and swelling of the face and neck and some dyspnoea. J. O. Affleck (Edinburgh Med. Jour., June, '98).

Treatment.—Inunctions of mercurial ointment, iodine, belladonna, and camphor ointments may be made externally, so as to combat inflammation. Depletion by calomel and soda, or by venesection, has given marked relief.

WOUNDS.—The vascular trunks passing through the mediastinum are so disposed that a missile which penetrates the cavity may traverse it without wounding any important vein or artery. The aorta and vena cava, when wounded, obviously do not admit of time for any arrest of the hæmorrhage. The most prudent course to pursue in all penetrating wounds is to hermetically seal the outer wound, after turning the patient upon the side affected, so that all blood may be allowed to escape. This course has recently stood the test of experience in military surgery, and Senn counsels it, in preference to opening the wound and ligating any bleeding vessels. In case a great amount of blood should collect in the mediastinum, it may be evacuated posteriorly by resection of a portion of the rib near the point of the greatest collection. The rise of temperature noticed after wounds of this character betokens more the absorption of fibrin than actual hæmorrhage.

[In the senior editor's experience a case occurred in which a pistol-shot traversed the mediastinum, the ball entering immediately over the heart and lodging upon the sixth rib of the right side behind the axillary line. The external wound was occluded, and the ball

was not removed until after the general shock and slight inflammatory reaction had passed off. The patient made a good recovery by the strict observance of masterly inactivity.

This case — compared to another in which the external wound was left open, terminating fatally — emphasizes the caution against cutting down and extracting a ball under such circumstances at the outset. The practice of removing balls lodged between the ribs is more honored in the breach than in the observance. When an opening already has been made by the entrance of a ball, it is not good surgery to make another for the extraction, until the wall behind has become solidified. J. McFADDEN GASTON, SR.]

THORACIC DUCT. — This may be the seat of disease through the extension of inflammation in the various forms of mediastinitis; or it may be itself in a normal condition and be the recipient of direct or indirect pressure sufficient to rupture its walls with extravasation of contents. Again, it is often the only part involved in a stab-wound of the mediastinum. The chyle cannot be lost to the system without serious results, and most wounds of the thoracic duct are fatal. At times, however, spontaneous closure of the wound occurs, when the incision is a longitudinal one.

[A recent case of recovery reported by H. W. Lyne, of Richmond, Va. (Virginia Med. Semimonthly, Aug. 26, '97) demonstrates the possibility of so desirable an ending.

The thoracic duct was ruptured, and closed spontaneously in the case of a child reported by Kirchner (Arch. f. klin. Chir., '85, p. 156). The displacements of heart, liver, and other organs was very marked.

The treatment in this case consisted in a puncture and evacuation of a portion of the fluid, followed by active purgation. The child had been violently thrown against a window-sill, so that she was injured about the level of the third rib. The puncture revealed the fluid extrava-

sated to be chyle. Six months after the accident, the girl is described as being in better health than before it.

The wounds of all kinds have been few if they have been recorded. W. W. Keen, of Philadelphia, has had one case of operation-wound of the thoracic duct. The wound was sutured very carefully with the finest semicircular Hagedorn needle and fine silk, and no untoward result occurred. The weight of the patient was carefully taken for some days after the operation and no great decrease was noticed. Keen records three other cases of wounds in the cervical portion of the thoracic duct.

These cases were also operation-wounds. One, that of Cheever (Boston Med. and Surg. Jour., '75, p. 422), died from exhaustion. Another case was Boegehold's (Arch. f. klin. Chir., '93, vol. xxix, p. 443). Wilms was the operator, and the patient recovered. The third case was in an operation of A. M. Phelps, of New York, who communicated the facts to Keen personally. The operation occurred June 4, and on June 11th the wound was closed by hæmostatic forceps, and the patient recovered, beginning to gain in weight after the closure.

Twenty cases of wounds of all kinds are mentioned, and many observations made during the treatment of them, leading to the inference that the duct was closed spontaneously in some of these cases and a collateral anastomosis was established; but the continual escape of chyle may cause death by the pressure of the extravasated fluid, resulting in pleuritis, or that death may be attributed to the immediate exhaustion, as in Cheever's case.

The usual size of the thoracic duct is that of a goose-quill, and the jet of chyle will be of low pressure and about the diameter of a straw. The junction of the left subclavian vein with the jugular vein is the site for the mouth of the duct to be found, but anatomists call attention to the somewhat frequent change in the location, due to the fact that the duct may empty its contents into the left subclavian vein by several mouths, comparable to the delta of a river (Med. and Surg. Reporter, May 12,

'94). J. McFADDEN GASTON, SR. and JR.]

LYMPHATIC GLANDS.—The lymphatic glands of the mediastinum are divided by Baréty into three sets: (1) the right and left peribronchial; (2) the right and left subbronchial; and (3) interbronchial. All these are particularly liable to inflammatory process.

Three cases in which mediastinal glands invaded the lungs, all in children under two years of age. Caseous glands in children found present in 110 cases out of the last 300 necropsies made at the Children's Hospital. Their occurrence apart from some tuberculous affection doubtful. Voelker (Brit. Med. Jour., May 9, '91).

Inflammation of the cellular tissue may be acute or chronic, primary or secondary. Inflammatory changes may be circumscribed or diffused. The condition of the tissues in the neighborhood is to be taken into account in determining the inflammation. (See ADENITIS.)

Tumors of the Mediastinum.

Symptoms.—The attachments of the tumor and the encroachment of the rapid growth necessarily have important bearings upon the symptoms manifested. For instance, in multiple sarcomata of the heart the heart-beat is rapid and irregular, but there may be no murmurs unless the valves are encroached upon. At times, instant death is caused by the pressure of the tumor upon the spinal cord—exposed by the erosions of vertebrae.

The adjacent organs, as well as the connective tissue forming the immediate seat of the tumor, being hyperæmic, the blood is unaërated if great pressure occurs, and cyanosis of the face, with varicosity of the veins of the chest and neck, occurs. The lymphatic glands of the neck are enlarged, especially the subclavicular.

Pressure upon the œsophagus causes dysphagia, and at times ulceration into the œsophagus. The ulceration may occur between the tumor and the trachea or thoracic duct.

The pulse is unequal; there is dullness of a fixed area near the sternum or clavicle, and often a distinct œdematous condition of the arms, neck, and chest; so that the arms may measure more in the circumference than the legs. Displacement of the heart- or lung- tissue occurs. Dyspnœa soon shows itself, but not to the extent that it does in pleurisy or empyema. Pain from motion, if adhesions are interfered with, may occur in some cases; but ordinarily very little pain is present. Exophthalmos is a frequent symptom, when the thyroid is involved in the tumor. Nervousness: the patient will often be unable to locate the seat of inconvenience.

The special features of mediastinal tumors may be illustrated by the following cases:—

Case I.—The tumor gradually encroached upon the heart so as to displace it one inch and a half to the left of its usual site. Temperature varied between 99°, 100°, and 102°. The pulse was 76. The left lung was collapsed and the sciagraph showed a shadow from the second rib to the diaphragm and from two inches to the left of the sternum to the left border of the chest. Aphonia supervened and the lungs were more and more collapsed. The left bronchial tube was occluded. The patient was improved, but not cured, by the use of chloride of calcium combined with iodide of potassium. A dosage ranging from 10, 15, to 20 grains of the former was added to 3 grains of iodide of potassium. The latter drug could not be tolerated in doses of 7½ grains. E. Fletcher Ingals ("International Clinics," '97).

Case of hæmorrhagic adenochondrosarcoma of the anterior mediastinum arising from the thymus gland, in a man of 20 years. He had shown swelling of face, neck, and left arm; dullness between the

sternum and in the left infraclavicular fossa, near the sternum as far down as the third costal cartilage. There was bronchial breathing near the root of the left lung and enlarged veins over the front of the sternum. The apex-beat was felt on admission, but soon ceased to be palpable, and the heart-sounds became extremely distant. Later there was dullness and loss of breath-sounds over the left lung, but, as effusion was suspected, paracentesis was performed in the left midaxillary line, and 40 ounces of blood-stained fluid withdrawn from a distended pericardium. This gave relief, but the patient became more dyspnœic and delirious, and eventually died two months after admission. At the autopsy a growth was found occupying the superior and anterior mediastinum and covering over half of the pericardium, to which it was adherent. H. D. Rolleston (Jour. of Path. and Bact., Jan., '97).

Diagnosis.—The symptoms which have been mentioned may serve the purpose of differentiating tumors of the mediastinum from abscesses if there is not present pain, chills and fever, elevated temperature, or very marked emaciation or apparent ill health. The age is also a means of determining upon a correct diagnosis. Benign or malignant tumors of the mediastinum may occur at any age, but aneurismal tumors usually occur after the age of forty-five.

The male and female suffer equally, though our own cases have been female.

Record of 134 cases of mediastinal cancer, 98 cases of sarcoma, 115 cases of abscess, 16 cases of non-suppurative inflammation, 21 cases of lymphoma, 7 cases of fibroma, 6 cases of hæmatoma, 11 dermoid cysts, 8 hydatid cysts, and 104 cases of various mediastinal diseases. Conclusions: 1. Cancer is more frequently found in the mediastinal spaces than any other morbid process. 2. Abscess is the morbid process next in frequency of occurrence. 3. Sarcoma occupies the third position as to frequency of occurrence. 4. Lymphomata and lymphadenomata occupy a fourth place, but are much more rare than the others mentioned. 5. The

anterior mediastinum is affected far more frequently than the other two spaces. 6. Most mediastinal growths occur in adults. 7. More males are affected by forms of mediastinal disease than females. 8. Cancer and sarcoma of this space are necessarily fatal. 9. About 40 per cent. of the cases of abscess recover. Hare ("Fothergillian Essay," '89).

Review of 67 cases of carcinoma of the mediastinum in children found in literature. As compared to adults, sarcoma is the most frequent morbid process, carcinoma next, and abscess third in order. Edwards (Archives of Ped., July, '89).

Case of carcinoma of the mediastinum in a young woman 27 years of age. The patient died of cyanosis, the diagnosis of tuberculosis having been made. The autopsy showed the mistake; also a neoplasm, which occupied the anterior and superior part of the mediastinum. Histological examination revealed carcinoma of fibrous stroma, well developed, presenting nothing special. Tissier (Bull. de la Soc. Anat., Dec. 20, '89).

Eight cases of primary malignant growth of the anterior mediastinum. The patients were all over 40, with the single exception of a woman aged 23,—a very acute case of carcinoma. Two were over 60. The history of illness dated from not more than six months. The disease was accompanied by pleural effusion in 4 cases: purulent in 1 and chylous in another. Letulle (Archives Gén. de Méd., Dec., '90).

Case diagnosed as aneurism of the aorta with paralysis of the recurrent, but which at the post-mortem examination proved to be a mediastinal carcinoma. In making a differential diagnosis between the two affections, it must be noted that paralysis of the recurrent, due to a mediastinal tumor, develops gradually. Hoarseness sets in, but again passes off, and a paresis can be demonstrated only after a considerable time. In aneurism the paralysis of the vocal cord is often the first symptom. Hæmorrhages are always an indication of the approaching end in aneurism, while in tumors there is not infrequently hæmoptysis at an earlier date. Schadowaldt (Laryn. Soc. of Berlin, '95).

The diagnosis of intrathoracic disease, especially in cases of suspected intrathoracic tumor, is often one of the most difficult problems and may be impossible of solution by the ordinary methods of clinical examination. The x-rays are a great aid in the solution of these questions. Three cases of intrathoracic disease in which the x-rays were used for the purpose of diagnosis by Watson. J. Magee Finny and Edward J. M. Watson (Brit. Med. Jour., March 15, 1902).

Prognosis.—Early treatment may cause a subsidence, if not a disappearance, of the disease.

Demantké has put on record a case of tumor of the mediastinum of very short duration. It occurred in a man aged 26. He died of suffocation, and the autopsy showed the tumor to have rested on the pericardium below, and to have extended up into the neck about the level of the clavicle.

Treatment.—Tumors of the mediastinum call for treatment according to the etiology of the disease present.

Syphilitic tumors require antisyphilitic medication. The most serious obstacles to operative intervention are encountered, but when a trap-door allows free access to the mediastinum, and the X-ray serves to diagnosticate bullets and tumors, great advance has been made toward the exploration of the important portion of the body, and we may hope for the removal of tumors.

Treatment of Mediastinal Disorders.

SURGICAL.—Operative procedures may be carried into the various portions of this division of the thorax with a fair prospect of affording relief to some pathological conditions heretofore regarded beyond the reach of surgery. Experimentation on animals, though not a sufficient test, has still demonstrated the feasibility of surgical interference in this comparatively-unexplored region.

If animals can survive the traumatism of entering the mediastinum from the front and rear of the thorax, as has been verified by experiments of Le Moyne Wills, De Forest Willard; Levy, of Berlin; and Zakharevitch, of Russia; it is evident that operations may be undertaken for the relief of mediastinal tumors, hydatids, and other morbid growths of this space.

Clinical observation upon the human subject has shown that diseased structures of the chest, as in other parts of the physical organism, are more tolerant of surgical interference than in traumatism of the contents of the thorax in their normal condition. It is therefore inferred that the operations upon the thoracic walls, and upon the tissues of the lung under abnormal conditions which are indicated, will be warranted in all such cases as have proved safe in the experiments upon dogs and rabbits. On the other hand, it is not a necessary consequence that operations upon the diseased structures of the chest in the human subject shall prove hazardous, because experiments on inferior animals in a healthy state have been unsatisfactory or have turned out unfavorably.

[The senior editor has proposed an improved method for exploring the thoracic cavity. R. F. Weir and J. D. Bryant have proposed openings into the mediastinum from the rear, while the operations of Jennings, Lawson, and Delorme contemplate the exposure of the contents from the front, but by the section of ribs at both sternal and lateral extremities, according to the incisions in the skin-flap. The improvement that is expected to be accomplished is in only one section of the bones, using the cartilages of the ribs for hinges.

The arm upon the side to be examined should be raised above the head. An incision is made in the midaxillary line, directly downward, from the third to the eighth rib, inclusive or exclusive, as the

case may warrant, with the division of the ribs either with the saw or bone-cutter, extending to the pleural lining without dividing it. Temporary means of arresting hæmorrhage should be employed, and afterward there should be a transverse incision carried forward from the upper extremity of the perpendicular along the upper border of the third or fourth rib, and another from the lower extremity along the upper border of the seventh or eighth rib, as may be requisite, extending in front to the costal cartilage. Any bleeding should be controlled before dividing the parietal pleura, in making either of these incisions. Scissors which have a blunt point on the internal blade may be used for dividing the pleura on each line, and, if the lungs have not collapsed previously, this will occur upon the entrance of the air into the chest. J. McFADDEN GASTON, SR. and JR.]

Considerable areas of the sternum can be resected with impunity. Seventeen cases collected in which masses of the sternum were removed for various diseases. Personal cases: One of resection of the manubrium, inner third of the left clavicle, and lower third of the left sterno-cleido-mastoid for sarcoma. The second case was one of carcinoma of the breast with secondary carcinoma of the sternum at the junction of the manubrium and gladiolus. Both breasts were successfully removed, and resection of parts of the manubrium and gladiolus was followed by recovery from the operation; but death from recurrence of the trouble occurred subsequently. W. W. Keen (Med. and Surg. Rep., Mar., '97).

MEDICAL TREATMENT. — The use of chloride of calcium in glandular enlargements of the neck has been recommended by Thomas J. Mays, and is a corroboration of the confident use of it in cases of mediastinal tumors.

Arsenic is also useful. It may be combined with mercurials, iodides, such as in the preparation known as Donovan's solution.

Medical treatment may lead to retrogression or, at least, the arrest of such growths when benign. Arsenic must be

given the first rank, and iodide of potassium in increasing doses and for a long enough time to judge of its effects in doubtful cases, as syphilis is always to be thought of. Millot Carpentier (*Revue Inter. de Méd. et de Chir.*, Feb. 10, '95).

Inoperable mediastinal tumors may be successfully treated by means of electrolysis and cataphoresis, using the negative pole when and where dissolution is needed and the positive with Donovan's solution where the cataphoric action of the drug is expected.

The exact diagnosis may not always be made, but the case may be treated in this way when the typical symptoms give presumptive evidence of sarcoma of the mediastinum. Less encouragement is promised for carcinoma.

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MELANCHOLIA. See **INSANITY.**

MÉNIÈRE'S DISEASE. See **INTERNAL EAR.**

MENINGITIS.—Gr., *μηνιγξ*, membrane; *τις*.

Meningitis (Cerebral).

Varieties.—Cerebral meningitis means inflammation of the meninges of the brain.

Pachymeningitis means inflammation of the dura mater. Pachymeningitis is external or internal, and acute or chronic in its duration.

Leptomeningitis means inflammation of the soft membranes, the *arachnoid*. The term "arachnoid" is here used to denote the pia mater and the so-called arachnoid membrane, which are always involved together in leptomeningitis. Leptomeningitis occurs as an acute or chronic disease, and when acute includes many etiological varieties, while the

causes producing chronic leptomeningitis are much more obscure.

It will be convenient to consider the subject of meningitis in the order indicated above, all the etiological varieties of acute leptomeningitis being included in the description of that disease. Inflammation of either membrane may spread to, and include the others; or the brain-substance itself, constituting a meningo-encephalitis.

External Pachymeningitis (Cerebral).

Definition.—External pachymeningitis means inflammation of the external layer of the dura mater. It is almost always secondary, and almost never a primary affection.

Symptoms.—The symptoms of external pachymeningitis are usually of very indefinite character, and vary according to the position, extent, and grade of the dural inflammation. When it follows traumatism there may be intense headache, nausea, vomiting, delirium changing into coma, local or general spasms, and, finally, unless relief is afforded, the collection of pus may cause more decided signs of septic infection and increased intracranial tension. In all cases the condition of the ears should receive the most careful scrutiny, since many of the cases are associated with suppurative aural disease. As the symptoms in themselves are by no means conclusive in their character, or in the mode of their development, a very careful study should be made of all the possible causes whenever this condition is suspected to exist.

Six thousand five hundred and eighty eyes excised at Moorfields Hospital, among which eight fatal cases have occurred. From report of five of these cases with autopsies and microscopical examinations, the following conclusions are reached:—

1. Meningitis may be present for a certain time without there being sufficient

symptoms to enable one to diagnosticate the disease.

2. Meningitis has been known to follow other operations besides the excision of suppurating eyes, and cases are also recorded in which the excision of an eye which was not suppurating has been followed by death from meningitis.

3. The changes seen in many cases indicate that the disease is of older standing than the symptoms would appear to indicate.

4. Infection may occur at any time from an eye which is suppurating, and the longer the pus is shut up in the eye the greater is the risk and the greater will be the absorption of products of supuration.

5. There are two ways in which meningitis may arise: (a) by direct extension along the optic nerve and structures passing through the sphenoidal fissure; (b) by infective material's being carried along the vessels.

6. The sooner the pus is got rid of the better; and, if it is thought not desirable to excise the eye, it should be at once opened, the contents completely removed, the sclerotic thoroughly scrubbed out, and both it and the surrounding parts rendered aseptic.

7. As the products of putrefaction may have soaked into the sclerotic and infected the surrounding parts, it is far better to remove it; good drainage is then insured, and every piece of useless and suppurating tissue is removed. C. D. Marshall (Royal London Ophthal. Hosp. Rep., vol. xiv, p, 305, '97).

A case of recovery from acute meningitis consecutive to ear disease. The acute inflammation of the ear, the clinical symptoms, and the condition of the cerebro-spinal fluid—the presence of polynuclear leucocytes and the cloudiness of the fluid in this case left no doubt at all as to the nature of the diagnosis. No importance was attached to the fact that the cerebro-spinal fluid was sterile, for it has been proved that in undoubted purulent meningitis no microorganisms may be present in this fluid. The case is certainly a very unusual one, for in by far the greater number of cases in which acute meningitis

is consecutive to middle-ear disease death speedily ends the scene. O. Fischer (Präger med. Wochen., Apr. 2, 1903).

A senile form of external pachymeningitis, running a more or less chronic course, is observed among chronic alcoholic subjects and those who have previously had syphilis or certain infectious diseases, such as erysipelas of the head. The symptoms present in such cases are those of senility with headache, usually vertical in position.

Diagnosis.—The diagnosis of external pachymeningitis can only be made by a careful study of the antecedent or associated conditions to which the affection is commonly secondary. The symptoms which may be present in these cases are simply those of cerebral irritation, and, in some cases, of cerebral compression, to which are added the general signs of the existence of a septic condition in the cases in which pus is formed. In cases running a more or less acute course the diagnosis will be made by a careful study of the history of the illness and of the associated conditions found upon examination of the patient. The history should especially refer to any traumatism or syphilitic infection. In the chronic senile cases the diagnosis must be largely inferential, when persistent dull headache is associated with mental deterioration and a history of alcoholism or syphilis.

Etiology.—External pachymeningitis is commonly associated with traumatism, sun-stroke, caries of the flat bones of the cranium, purulent aural disease, syphilis, erysipelas, and probably certain other acute infections. Traumatism and caries of the cranial bones are the chief etiological factors producing inflammation of the external layer of the dura mater.

Pathology.—Post-mortem examination in these cases reveals very often great

thickening of the bones, especially of the inner table of the skull, and a collection of pus between the bone and the dura mater. In the syphilitic cases this thickening of the bone is often very marked. Osler refers to a case at the Montreal General Hospital in which the frontal lobes were so compressed by thickened bone and purulent effusion that the anterior vertical measurement of the brain was only 2.5 centimetres, while the similar posterior measurement was 8 centimetres. In other cases the bone is slightly, if at all, affected, while there is considerable thickening of the dura mater, consisting of a partially-organized connective tissue, which may be softened and broken down in particles. This condition is chiefly observed in senile subjects, and is usually associated with widespread vascular degeneration. During my residence at the Morris Plains Hospital several such cases came under observation, and I have no doubt but that the post-mortem records of the hospitals for the insane will reveal this lesion as quite common among the chronic and senile insane.

Prognosis.—The prognosis is always grave, and especially so in cases affecting old subjects. When, in purulent cases due to traumatism, the collection of pus is evacuated and drained by the use of the trephine, the outlook is better, and a final cure results in some cases. The syphilitic form is often remarkably improved by specific treatment.

Case of true tuberculous meningitis in which the patient completely recovered. The diagnosis was made by removing a portion of cerebro-spinal fluid and inoculating it to a guinea pig. The result was tuberculous infection. Tubercle bacilli could not, however, be found in the cerebro-spinal fluid. Cyto-diagnosis confirmed the tuberculous nature of this liquid. Recoveries from true tuberculous meningitis are so rare

that their occurrence has been doubted by many. Avanzino (*Riforma Medica*, Aug. 26, 1903).

Treatment.—The treatment of external pachymeningitis must include that of the primary condition giving rise to it. When suppuration occurs after traumatism, the trephine should be used with the hope of curing the patient, if the operation is done early and before the brain becomes affected by serious congestion or inflammation.

The cases resulting from syphilis should be treated actively with anti-syphilitic remedies, and, if the general strength of the patient permit, large doses of potassium iodide should be given with the bichloride of mercury. The senile cases demand careful regulation of the digestion, the use of general tonic measures, and the relief of pain.

Internal Pachymeningitis, Cerebral (Hæmorrhagic Internal Pachymeningitis; Hæmatoma of the Dura Mater).

Definition.—Internal pachymeningitis means inflammation of the internal surface of the dura mater. It is almost always a chronic affection, and is far more common in hospitals for the insane than in general hospitals or in private practice. Osler states that during ten years he saw no case of this kind at the Montreal General Hospital, but while at the Philadelphia Hospital four cases were observed by him within a period of three months. The pathological meaning of the lesions found in this disease is still a matter of dispute, some authorities contending that they are primarily hæmorrhagic; while others believe, with Virchow, who first accurately described the condition, that they are primarily inflammatory. The weight of the evidence seems to the writer to be upon the side of the theory of their inflammatory origin, while it is to be admitted that cer-

tain cases appear to arise from hæmorrhage. The disease occurs in old age, or in those who have lived dissipated lives, and are prematurely aged in consequence.

Symptoms.—The symptoms of hæmorrhagic internal pachymeningitis will vary according to the extent of the lesion, which is usually bilateral. There may be paresis or paralysis, vertigo or apoplectic seizures, dull or sharp pains in the head, mental hebetude or stupor, inequality of the pupils, spastic paralysis of one or more limbs, and, as the case progresses, acute exacerbations of symptoms occur from time to time. Some writers mention optic neuritis, conjugate deviations of the eyeballs, and nystagmus as symptoms of this condition. All of the symptoms are very varied and irregular in development in different cases, and from this fact their true nature is only rarely suspected during life. During the intervals between the more acute seizures, which are usually apoplectic in nature, the patient may enjoy good general health, and only in the later stages of the disease present continuous symptoms. Severe epileptiform convulsions are sometimes marked features of these cases, having been observed by the writer in two cases which presented characteristic post-mortem lesions.

In 1500 autopsies pachymeningitis interna hæmorrhagica met with in only 4 instances. In 3 of the 4 cases death resulted from prolonged convulsions, the fourth dying from an acute enteritis, with no symptomatic evidences of the pachymeningitis except restlessness and slight rigidity. In none of the 4 cases was there noted any paralysis. Northrup (Med. Record, Aug. 3, '90).

Speech is often slow, the mind fails more or less rapidly, and there may be acute maniacal attacks. According to

certain writers, hæmorrhagic internal pachymeningitis may occur as an acute disease in rachitic children, but such lesions must be extremely rare.

Finally cases presenting wide-spread bilateral lesions of this disease have been observed by the writer in which none of the above symptoms were noted during life.

Diagnosis.—The symptoms are so indefinite that a positive diagnosis is impossible. The majority of the cases are diagnosed on the post-mortem table. Persistent dull headache of the vertex, with mental hebetude and a history of apoplectic seizures at irregular intervals, with or without some form of spasm or paralysis, may cause us to suspect this lesion, especially when these symptoms appear toward the close of a broken-down and dissipated life.

Etiology.—This disease, as has already been remarked, occurs chiefly among the insane and the subjects of other chronic nervous diseases. Usually the subjects affected are old or prematurely broken down by alcoholism, syphilis, or tuberculosis, or by prolonged dissipation of various kinds. By far the majority of cases occur in men. It is quite often found associated with general paralysis of the insane, and is more often still observed post-mortem in cases of terminal dementia in which no symptoms indicative of its presence were observed during life.

Traumatism and sun-stroke are thought by some to be causes of this affection; but from its very chronic nature, and the fact that it usually occurs in old age, exact information is very often wanting, and the connection between antecedent traumatism or sun-stroke impossible to trace. There is little doubt, however, that both of these causes may contribute some of the cases.

Case of hæmorrhagic pachymeningitis in a man, aged 57, who was thrown from a tricycle with great force on his head and shoulders. Complete recovery. W. B. Goldsmith (Amer. Jour. Insanity, June 15, '88).

The most important causes clinically are those which predispose to early degenerative changes in the blood-vessel walls, and to a general weakened condition of the normal resistive powers of the bodily tissues. Heredity probably plays an important part in the genesis of these cases, in common with its influence in determining insanity and nervous diseases in general.

Pathology.—The macroscopical lesions observed post-mortem are thin or thick, highly-vascular, subdural membranes, usually bilateral, and limited more frequently to the parietal regions, although they may extend much beyond these limits. Within or beneath the substance of this poorly-organized membrane there may be found a large clot, but numerous fine capillary hæmorrhages are more commonly met with. In some of the cases no hæmorrhage is to be seen, and in these cases there is only the more or less firm fibroid membrane, containing numerous blood-vessels and lying in contact with the under surface of the dura mater, over the vertex of the brain. Sometimes this membrane is divisible into several apparent layers, as of several successive accessions of growth; in other cases it is merely a very thin vascular membrane, stained brownish or reddish from more or less recent capillary effusions of blood. When large collections of blood are found, they are often encysted within layers of false membrane, and the blood is partially broken down, and pus may even be formed in some cases. The membrane which is supposed to be the initial lesion of this condition is undoubtedly of dural origin and de-

rives its blood-vessels from the dural vessels. It should be remembered, however, that so good an authority as Bevan Lewis believes that the hæmorrhage is the primary lesion and that the membranes are formed from organization of the effused blood. The view of Virchow is, however, more generally accepted at the present time, and that is that the membrane is the product of inflammation and that the hæmorrhages found are distinctly secondary to the poorly-formed inflammatory membranous exudate. The cases which show very hard fibrous membranes without any appearance of hæmorrhage tend to support the theory of inflammation.

Two cases of hæmorrhagic internal pachymeningitis in children. Hæmorrhagic pachymeningitis is a lesion that should be thought of whenever convulsions and unnatural rigidity, with deepening coma, occur in a rachitic or cachectic child, under one year of age. The new membrane must be regarded as originating from the proliferation of dural endothelial cells, or, more probably, from the subendothelial connective-tissue cells. The new cellular connective tissue is exceedingly likely to be the seat of development of new blood-vessels with thin walls. Even in cases that may be supposed to have originated from hæmorrhage, an intimate connection must be recognized between the organization of the clot and the proliferation of dural connective-tissue cells. In some cases there seems to be little inclination to hæmorrhage; in others there are numerous, punctate hæmorrhages from the delicate vascular membrane. The membrane varies in thickness, in some cases being so delicate as to be readily overlooked, in others reaching two or three lines in thickness. C. A. Herter (Amer. Jour. Med. Sci., Aug., '98).

Prognosis.—The prognosis is most unfavorable. When the lesion can be suspected it is not usually amenable to any known treatment. Especially is this true after paralytic seizures occur and the

general condition of the patient is broken down by disease. Death usually occurs from a general failure of the vital powers or acutely in one of the apoplectic or convulsive seizures.

Treatment.—As soon as the affection is suspected the constitution of the patient should be built up by hygiene, tonics, good food, rest, and every possible means used to increase his vitality. Afterward the iodide of potassium should be given in small doses for prolonged periods. When there is a history of syphilis, larger doses should cautiously be given, with the addition of small doses of mercury in the form most acceptable to the stomach of the patient.

Precedence given, in treatment of syphilitic meningitis, to the iodide of sodium. Nutritious feeding considered most important. When sedatives are required, paraldehyde is pre-eminently indicated. Dauchez (La France Méd., Sept. 12, '90).

The treatment of the acute apoplectic and convulsive seizures is that of any intercranial hæmorrhage. Perfect rest, ice-bag to the head, with full doses of chloral and opium unless they are contra-indicated by other diseased conditions of the patient. Leeches are mentioned as efficacious by some writers. They may be applied to the temples or to the mastoid. The writer, however, has used blisters to the nape of the neck or over the shaved vertex, with seeming benefit in such cases. The bromides are also useful, in combination with opium and chloral, in controlling mental and motor restlessness during the convalescence from the attack.

Acute Leptomeningitis.

Definition.—Acute leptomeningitis, means inflammation of the arachnoid, the vascular and nutritive envelopes of the brain.

Varieties.—Acute inflammation of the soft membranes enveloping the brain

occurs from a variety of causes, nearly all of which operate by infection of these membranes. In location and extent the inflammation may be basilar, cortical, unilateral, or general. Very many pathological and etiological varieties of meningitis are described. Pathologically acute leptomeningitis may be *suppurative* or *purulent*, *non-suppurative*, *serous*, *tubercular*, *syphilitic*, and *epidemic cerebro-spinal*. Etiologically the disease may be classified as *simple* (or *idiopathic*), *traumatic*, and *infective*. The infective group includes the great majority of the cases.

General Symptomatology.—The symptoms observed in cases of acute leptomeningitis will depend in great part upon the location and extent of the inflammation, while very often its symptoms will be combined with those of one or other of the acute general diseases to which the acute leptomeningitis is an accompaniment or sequel. Those symptoms which are quite common in all forms of acute leptomeningitis are headache, vertigo, fever, nausea, restlessness, somnolence, stupor, abnormal changes in the pulse and respiration, muscular spasms, optic neuritis, and spasms or paralysis of the ocular muscles. Almost any of these symptoms may be either very marked features of any given cases, or very slight, or even entirely absent. Perhaps the most constant symptoms are pain in the head, mental changes during the initial stage, fever (although afebrile cases are reported); muscular twitchings, or spastic condition of the muscles, especially those of the neck and spine; and general convulsions.

Pain in the head is a very frequent symptom, but if the disease occurs during the progress of some grave general disease it may not be complained of. Irritability, restlessness, and delirium in

cases ushered in by high fever are exceedingly common, and coma very often rapidly supervenes in such cases, accompanied by more or less muscular rigidity or occasional convulsions. This is particularly true in infantile and other cases of basilar meningitis. The location and extent of the inflammatory process is far more important in determining the symptoms in any given case than is the character of the exudate, but the symptoms are all very largely influenced by the etiology of the case. In all cases, therefore, the previous history is of the utmost importance in order to enable us to attach due significance to the symptoms actually present.

The symptoms of *acute basilar leptomeningitis* depend upon the amount and distribution of the inflammatory exudate, which may involve any of the cranial nerves, thus giving motor, sensory, and special sense disturbances, deepening very often into paralysis of all their functions. Disturbances of sight, hearing, smell, and taste are common. Pain is usually confined to the head, face, and upper spinal regions. Ptosis and strabismus are frequent symptoms. According to Ott, very rapid respiration is indicative of involvement of the tuber. There is commonly retraction of the head, and often more widespread spastic conditions of the muscles. In nearly all cases fever is present, and may be of a severe type, but more commonly it is of moderate grade, and may be entirely absent in cases occurring among emaciated children in poor surroundings. When hydrocephalus occurs as a result of the inflammation, the spastic muscular condition is succeeded by more or less general paralysis, due to the increased intracranial pressure, which may directly or indirectly affect the motor areas. A fairly-common symptom

preceding death is Cheyne-Stokes respiration, which may, however, appear quite early in the disease, and be present continuously or intermittently until the termination of the case. It is also common in other varieties of meningitis.

The symptoms of *acute cortical meningitis* are more markedly motor in character than in basilar meningitis, and cranial nerve-disturbances and palsies are not present, unless the base is also affected. It must be remembered that quite frequently cortical and basilar meningitis are associated. The chief distinctive features of cortical leptomeningitis are due to involvement, by pressure or irritation, of the motor areas underlying the portion of the membranes affected. Thus, we may have localized spasms of the arm or face and tongue; motor aphasia either partial or complete; convulsions, which may be Jacksonian or general in type; and varying forms of paralysis, according as more or less of the motor zone is involved. Optic neuritis is not so common as in basilar meningitis. In the early stage of the disease active delirium is often present in severe cases, giving way quickly, however, to apathy, stupor, and coma as the disease progresses and the exudate increases in amount. The foregoing statement of the symptoms observed in cases of acute leptomeningitis applies to all cases of the disease, except that, according to the special pathological or etiological variety of the disease, they are divided into many clinical groups; all of which, however, partake of the same general characteristics. The symptoms of the chief clinical varieties met with will now be briefly given.

SIMPLE ACUTE LEPTOMENINGITIS (CEREBRAL).—This form of acute leptomeningitis occurs in infancy and early childhood. Prodromic symptoms are

few or entirely wanting. The patient may exhibit some restlessness or irritability for some days before the disease actually begins. The onset is usually sudden, with fever, vomiting, headache, delirium, and often early and repeated convulsions. The fever is commonly decided and ranges from 102° F. to 105° F. during the first few days. In very violent cases coma comes on early and often with very few previous symptoms, and is attended by rigidity of the cervical muscles, and also frequently of one or all of the limbs. The pulse is rapid at first, but usually becomes slower after some days, and is again more accelerated later, when it is apt to be intermittent. The pulse in these cases is subject to the greatest variations, and may be either abnormally slow or fast, but it almost always is deficient in tension. There is usually hyperæsthesia of the sight and hearing. The pupils are contracted at first, or irregular in size, and as the disease progresses both may be equally dilated. The muscular soreness in these cases is often extreme, the slightest pressure anywhere over the body causing acute pain. Finally all of the senses are obtunded and a condition of complete coma with persistent muscular rigidity results. This rigidity may affect only the cervical muscles, but more commonly it is more widespread, and affects the limbs. The *tache cérébrale* is present. As death approaches, muscular paralysis is more pronounced, the patient has spells of collapse, Cheyne-Stokes respiration often is present, the sphincters relax, and death occurs in from a few days to a few weeks from the beginning of the illness. In those cases which recover the invasion is commonly less abrupt, the fever of lower type, and all of the symptoms less severe. It is probable that some of the cases, which from lack of information we must clas-

sify as cases of simple leptomeningitis, really owe their origin to infection which cannot be traced. The number of cases of purely simple character is small compared with the larger class in which direct or indirect infection is the causative agent.

The same symptomatology practically applies to all of the acute infantile cases, although the cases differ much in severity and duration.

ACUTE TUBERCULAR LEPTOMENINGITIS.—This form of the disease is clinically the most important since it is that most commonly met with.

The clinical history of tubercular, or basilar, meningitis, as it is more commonly called, differs in some particulars from the class of cases above described, but these differences are by no means sufficient to enable us to always positively differentiate them. The prodromal signs of the disease are usually much more prolonged than in cases of simple leptomeningitis. For a week or two the patient is noticed to be unwell. The symptoms during this period vary a great deal, but include restlessness, peevishness, mental apathy or irritability, and disturbed sleep, transient headache, coated tongue and impaired appetite, and occasional vomiting, and a decidedly pale or cachectic color of the skin. Rarely these symptoms are not observed and the onset may be acute. Soon fever makes its appearance and rises progressively, with morning remissions, ranging from 99° to about $101\frac{1}{2}^{\circ}$ F., although the evening temperature may be much higher early in the course of the disease. Succeeding this prodromal period more decided and characteristic signs slowly develop. These are irregularity of the pulse, which has already been accelerated in correspondence to the degree of the fever present; irreg-

ularity of respiration, with retraction of the abdomen; dilatation of one or both pupils, with slow lateral movement of the eyes; and heightened fever at night, with local flushings of the face. Following these or accompanying them are slight or decided facial twitchings or a general convulsive seizure. Some form of paralysis soon develops. This may be ptosis, strabismus, amaurosis, facial paralysis, or hemiparesis, or hemiplegia. The temperature still ascends, opisthotonos is marked, the abdomen is greatly retracted, and Cheyne-Stokes respiration often precedes death, which commonly occurs within four or five weeks. The ophthalmoscope sometimes reveals tubercles of the choroid.

Case of a boy, 17 years old, the victim of acute miliary tuberculosis, who was affected with a spasmodic condition of the right hand resembling athetosis, and who also had left hemiparesis. Diagnosis made of tubercles in the external part of the thalamus and the posterior part of the internal capsule. The autopsy confirmed the diagnosis, but also showed tubercles in the upper right ascending frontal convolution. Ewald (*Gaz Hebd. de Méd. et de Chir.*, May 2, '91).

Tubercular meningitis presents no symptoms during the onset. The only sign is a disharmony,—viz., an irregularity (dissociation) of the respiratory movements of the diaphragm and the thorax, which sets in during the first days of meningitis. Simon (*La France Méd. et Paris Méd.*, Mar. 29, '95).

Study of 10 cases, all of which showed a diplococcus in the cerebro-spinal fluid, identical with Weichselbaum's diplococcus intracellularis meningitidis. In some the bacillus influenzae and the bacillus of tuberculosis were associated, but in others the diplococcus was obtained in pure culture. The clinical picture was that of the so-called posterior basal meningitis. The latter, therefore, is probably a sporadic form of cerebro-spinal meningitis, of which the diplococcus intracellularis meningitidis is the

typical organism. Hunter and Nuthall (*Lancet*, June 1, 1901).

TUBERCULAR CEREBRO-SPINAL LEPTOMENINGITIS.—Cases of tubercular cerebro-spinal meningitis have been studied by Hayem, Moxon, Magnan, Shaw, Liouville, Eskridge, Mills, and others. It is, however, a comparatively rare affection, and when it does occur it is usually in the course of generalized tuberculosis. According to Eskridge, the tubercular deposits may occur first in the spinal membranes; but more commonly the cerebral and spinal membranes are affected together. In the case studied by Eskridge and Mills and referred to by the latter in his work on nervous diseases, the patient was 16 months old, and presented the following symptoms: "Headache, lateral movements of the head, temperature of 103° F.; pulse, 150; respiration, 84; and tetanic convulsions, with some imposed clonic movements, and rigidity of the limbs" (Mills). This case ran a course of eight months. The post-mortem diagnosis of tubercle could not be made macroscopically in the case, but was established beyond question by an expert microscopist. The symptoms observed in such cases necessarily will depend upon the mode of development, and upon the relation between the spinal and encephalic tubercular lesions.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.—This form of leptomeningitis is a specific infectious disease, but presenting as its chief pathological lesion a widespread inflammation of the meninges of the brain and spinal cord. It has been recognized as such for nearly one hundred years. Other names sometimes used are "spotted fever," "petechial fever," and "malignant purpuric fever." It occurs as a sporadic epidemic or endemic disease, and varies much in malignancy in different epidemics. (a) A very malig-

nant form is described in which death often occurs before the exudate has time to appear. The symptoms in this malignant variety are sudden onset, with chills, pain in head, extreme physical and mental depression, local or general muscular spasms, fever of 102° to 103° F.; feeble pulse, becoming slow; purpuric rash (not constant) and death inside of twenty-four hours, or even less, as in a case recorded by Stillé, in which death occurred within ten hours.

Case of meningitis of unknown origin, ending fatally quite suddenly, with sharp elevation of temperature from normal to 105° F. in less than two hours, coma, abolition of all reflexes and of respiration, and apparent death, though the heart continued to beat and the pulse to be perceptible for thirty-eight hours afterward, artificial respiration being practiced almost continuously meanwhile. Smith (Va. Med. Mthly., Oct., '93).

From March 19 to May 21, 1903, there were in New York 64 cases of cerebro-spinal meningitis, and during the same period of the present year there were 498 cases. In the present epidemic the pulse, while variable, has not shown the tendency to intermit which is so marked in other forms of meningitis. The respiration is not apt to be so irregular and sighing, and the purpuric rash is extremely rare. The present epidemic, while most prevalent among the poor, is not confined to any part of the city. As previous epidemics have usually disappeared with the advent of warm weather there is ground for hope that the present visitation will soon be over. Chapin (Medical News, June 4, 1904).

(b) The ordinary form also begins suddenly, with few premonitory symptoms, with a chill, severe headache, repeated attacks of vomiting, and moderate fever. Very early there is rigidity of the posterior cervical muscles, causing severe pain. There is photophobia and hypersensitivity to light and noise. Often there is severe pain in the limbs and back. Tonic and choreic spasms of the limbs occur,

and, in young children, general convulsions are more common than in older children or adults. Strabismus, followed by paralysis of the eye-muscles, with involvement of the facial muscles, frequently occurs. During the early stage delirium may be a very marked feature, but soon the patient sinks into a stuporous condition, but often continues to suffer from the severe head-pains and body-pains until the stupor becomes coma. The disease is very irregular in its course, remissions are frequent in all its symptoms, and the fever especially is apt to be most variable.

The respiration is not apt to be so much disturbed as in tubercular meningitis. The pulse is often extremely rapid in young children, but in older persons it may be either rapid or distinctly slow, full, and strong in the early days of the disease. The petechial rash occurs in a considerable proportion of the cases. Stillé noted its absence in thirty-seven out of ninety-eight cases in the Philadelphia Hospital. Osler states that petechial and purpuric spots were commonly present in his cases in Montreal. Other forms of eruptions noted as occurring in this disease are herpes labialis, erythema nodosum, ecthyma, and pemphigus. The spleen is enlarged, and constipation is the rule. Albuminuria, glycosuria, and hæmaturia have been observed. The disease runs a variable course from a few days to several months. Of the fatal cases a majority die within the first week. Recovery is often slow and complications are common, including pneumonia, pleurisy, pericarditis, and painful forms of arthritis in some epidemics of the disease.

Peripheral or multiple neuritis occurs in some cases of cerebro-spinal meningitis. This coincidence observed in three cases. C. K. Mills (Medical News, Mar. 3, '88).

Eye-symptoms studied in epidemic of

cerebro-spinal meningitis. Various affections noted with more or less frequency are conjunctivitis, altered pupils, pus in the anterior chamber, choroiditis and iritis, suppurative cyclitis, retinitis, panophthalmitis, neuritis, etc. The fundus should always be examined, as there is a direct communication between the arachnoid space and the deeper structures of the eye through the intravaginal space.

Of 35 cases, 21 fatal. Case of child, aged 20 months, in which there was thrombosis of the central vein with an hæmorrhagic retinitis. The fundus was normal in only 7 cases, and 1 of these 7 had divergent strabismus and dilated pupils, another marked nystagmus, and another greatly dilated pupils. In 6 cases there was optic neuritis, and in 19 great venous engorgement and tortuosity, with congestion of the optic disk. Of the 3 cases in which there was an absence of all eye-symptoms, 2 recovered and 1 died. All cases of strabismus (8) were divergent, and the right eye was always affected. Every extensive epidemic is apt to be associated with a special type of eye disease. Randolph (Johns Hopkins Hosp. Bull., June, July, '92).

Thirty cases of cerebro-spinal meningitis in an epidemic. In 17 cases the most striking symptom was herpes, several of these cases dying. In 11 cases the urine contained albumin, but no casts; in 2 cases there was polyuria, and in 1 glycosuria, the patient dying on the fourth day. Früs (Univ. Med. Jour., July, '93).

Case of cerebro-spinal meningitis in which persistent hæmaturia was present. Biggs (Epitome of Med., Aug., '93).

Many of the eye-symptoms of importance in meningitis are largely motor. Thirty-eight cases of meningitis reported—13 simple leptomeningitis, 12 cerebro-spinal meningitis, 13 tuberculous. In 8 of the 13 cases of leptomeningitis there were no eye-symptoms. The patient with purulent meningitis, in which no eye-symptoms were present, showed, post-mortem, the meninges covered with pus and extensive adhesions between the pia and dura mater. In the cases of cerebro-spinal meningitis eye-symptoms were absent in 7. Loss of iris-reflex was present in 1, dilated and fixed pupils in another,

strabismus in a third, and in the fourth the pupils were dilated, but reacted to light.

No eye-symptoms were present in 8 of those having tuberculous meningitis. Cerebro-spinal meningitis has as prominent symptoms paralysis of third, fourth, ophthalmic division of fifth, sixth, and seventh nerves, with nystagmus and ptosis from cortical lesions; choked disk, optic neuritis, perineuritis, plastic and suppurative iritis, conjunctivitis, oedema of the lids, hemianopsia as a cortex or tract lesion. In simple meningitis or leptomeningitis the eye-symptoms are of more importance in determining the diagnosis than in the cerebro-spinal type. The most reliable is optic neuritis. A. E. Davis (Med. News, June 5, '97).

By practicing lumbar puncture in meningeal disease and centrifugalizing the turbid serum thought to point to tubercle, a large number of lymphocytes and large mononucleated leucocytes were found. As observed by Monod, the cells are also present in the cerebro-spinal fluid of tabetic and general paralytic patients. Thought to be a characteristic sign of meningitis. Widal, Sicard, and Ravaut (Sem. Méd., Jan. 23, 1901).

The sequelæ include blindness, deafness, chronic hydrocephalus, severe neuralgias of the head, and mental disease of various types.

Syphilis may very rarely cause an acute cerebral leptomeningitis, but it is much more commonly a cause of chronic leptomeningitis. The symptoms do not differ from other varieties of acute leptomeningitis, excepting for their association with other evidences of syphilis, such as gummata or specific ulcerations of the bones.

In acute syphilitic meningitis extremely-intense headaches, repeated vomiting, and occasional elevation of temperature are the first symptoms. If the process be at the base, vertigo, mental troubles, symptoms of compression of the cranial nerves, polyuria, and bulbar phenomena supervene, and profound depression suc-

ceeds, ending in fatal coma. If the convexity be chiefly affected, phenomena of excitement predominate; noisy delirium, repeated convulsions and hallucinations. Coma comes on later—often with hemiplegia or monoplegia. Specific treatment is of no use in these acute cases. Teissier and Roux (Treatment, Mar. 10, '98).

TRAUMATIC LEPTOMENINGITIS. — The symptoms present in cases of fractures, concussion of the brain, or perforating wounds of the skull are, from the nature of these injuries, often of a mixed character, depending upon the extent and severity of the traumatism, and whether there is also injury to the brain-substance. Under these circumstances the leptomeningitis occurs as a complication of the injury, and presents no special symptoms other than those already referred to as common in all cases of the disease. These will depend for their intensity and grouping upon the position and extent of the inflammation, and will be mingled with those of the injury itself.

Diagnosis. — It is necessary to distinguish the various types of acute leptomeningitis from each other, from encephalitis, from the meningeal symptoms of the continued fevers, acute rheumatism, pneumonia, tetanus, cerebral tumor and abscess, uræmia, the hydrocephaloid disease of Marshall Hall, and hysteria.

Acute leptomeningitis, either purulent or sero-purulent, is separated from cases of so-called serous leptomeningitis (external hydrocephalus) chiefly by the greater frequency of the former, the more prolonged and milder course usually of the latter affection, and, as advised by Quincke, by lumbar puncture. If the fluid obtained has a specific gravity of 1009 or less, and contains more than two parts of albumin per thousand, Quincke regards it as hydrocephalic fluid. Fever is slight or absent

in serous meningitis and choked disk is more common than in acute purulent or suppurative meningitis (Mills). The diagnosis of the serous meningitis described by Quincke from certain cases of tubercular leptomeningitis is impossible unless there is a distinctly tubercular history obtainable.

Lumbar puncture renders no services therapeutically in tuberculous meningitis. For diagnostic purposes, however, it may be of use in some cases, for a clear, watery fluid with the early signs of meningitis denoted tuberculous meningitis, and tubercle bacilli may be found. That these are not more often discovered the writer believes to be due to too early puncture. But by the time the bacilli are found the clinical diagnosis is certain. Therefore the writer concludes that lumbar puncture should only be performed when it is necessary for therapeutic purposes or to settle the diagnosis. J. K. Friedjung (Wiener klin. Wochen., Oct. 31, 1901).

Simple acute purulent leptomeningitis of the basilar type differs from tubercular basilar leptomeningitis by its more abrupt invasion, the absence of signs or history of tuberculosis, and tendency to higher range of temperature; while prodromic symptoms, with more irregular course, temperature, and pulse, and possibly choroidal tubercles, are common in the latter affection.

Epidemic cerebro-spinal leptomeningitis is distinguished from the other varieties by the presence, in the vicinity, of other cases of the disease; its very sudden onset with severe rigors and marked pains in back and limbs; its spinal symptoms, the presence of its skin eruptions, and by the alarming intensity of all the cerebral and spinal symptoms, and the rapidity with which they attain their maximum. The sporadic cases of the same disease run a less acute course, are of extremely rare occurrence, and are much more liable to be confounded with

one of the continued fevers presenting grave nervous symptoms.

In cases of meningitis of doubtful diagnosis lumbar puncture is of great importance. The operation consists in withdrawing cerebro-spinal fluid from the lowest part of the vertebral canal by means of a puncture carried through the ligaments connecting the lumbar vertebræ. A hollow needle with trocar and cannula, or an hypodermic needle may be used; but it is better not to aspirate. Following method recommended: The child is placed upon its right side, with the thighs so bent that it lies curled up, with the vertebral column well bowed. In those suffering from cerebral irritation, in the restless, and in those who are not yet unconscious, it is necessary to give an anæsthetic. The exact position of the patient is unimportant, so long as the vertebral column is kept convex at the seat of puncture from the time the needle is inserted until it is withdrawn.

The skin over the lower part of the back is well washed with soap and water, dried, and sponged with a solution of corrosive sublimate (1 in 2000), while the trocar and cannula of the smallest hydrocele size is sterilized by boiling in a test-tube for three minutes. To find the most suitable point for puncture a perpendicular is dropped upon the bed from the highest point of the crest of the ilium (the patient being on the side), for this line crosses the upper border of the spine of the fourth lumbar vertebra, and thus marks the position for puncture. The trocar and cannula are plunged through the skin immediately to one side of the spine of the third lumbar vertebræ, and on a level with its lower border. It is pushed on boldly until the point of the trocar touches bone—the lower border of the lamina. The handle of the trocar is then directed upward, so that its point passes downward over the lamina. It is then pushed onward until a grating sensation is felt.

It is important to see that the end of the cannula is well beveled and fits closely to the neck of the trocar. The trocar is withdrawn as soon as it is felt that it has fairly entered the subarachnoid space, care being taken that the cannula is not

at the same time pulled out of the vertebral canal. D'Arcy Power (*Clin. Jour.*, May 20, '96).

Kernig's sign sought for in 19 cases of meningitis, 9 of which were epidemic cerebro-spinal meningitis, 7 tuberculous, 2 pneumococcal, one syphilitic with an acute process superadded. The sign was present in 17. In the two negative cases, both in children, the examination was made shortly before death, at a time when the musculature had relaxed. Many patients with diseases other than meningitis were examined as to the existence of the phenomenon; of 100 examined, it was present in 2, absent in 98. One of the two was a case of subdural hæmorrhage; the other was one of gonorrhœal rheumatism of one knee, and in this case the local condition may have played a part.

It seems justifiable to regard Kernig's phenomenon as present in 80 or 90 per cent. of cases of meningitis and as only exceptionally present in other affections. J. B. Herrick (*Amer. Jour. Med. Sciences*, July, '99).

Of 21 cases of the disease observed during the recent epidemic in Baltimore, Kernig's sign was found in all in which it was looked for. Fries found the sign in 53 out of 60 cases. Its presence is no indication of the intensity of the spinal involvement. William Osler (*Canadian Pract. and Review*, Aug., '99).

Kernig states that if one lays the child down and flexes the thigh on the abdomen it can extend the leg; but that if one sits the child up in bed and then flexes the thigh on the abdomen it cannot extend the leg, although it could do so when lying down. During the last year a considerable number of cases of cerebro-spinal meningitis have been personally seen in which Kernig's sign was reversed; that is, the leg could be extended when sitting up and there was inability to extend it when the patient was lying down. Kernig's sign is a good sign as an aid when other signs are not positive. Its absence in infants is easily explained by the condition of normal hypotony in young babies.

The question of particular importance is the fact that the absence of Kernig's

sign might possibly make one err in thinking that a case was not one of meningitis, but simply one of meningismus: a diagnosis otherwise often extremely difficult to make. F. A. Packard (*Annals of Gynec. and Pediatrics*, Mar., 1900).

One hundred cases, all non-meningitic, both febrile and afebrile, examined for the presence of Kernig's sign. In every case both legs were examined for the sign in both erect and recumbent postures, excepting when the condition of the patient would not admit his sitting up. In 5 cases Kernig's sign was present; 3 showed the sign unilaterally, and 2 bilaterally—1 case of uræmia and 1 case of typhoid fever. In both of these cases the sign could not be obtained after recovery. Kernig's sign persisted in the 3 remaining cases,—2 cases of right-sided hemiplegia, and 1 of typhoid fever,—and in all it was obtained on but one side. In both cases of typhoid fever which showed the sign delirium was marked and persistent. This predominance of mental symptoms may have been an indication of febrile or toxic cerebral irritability, which might have in some manner been accountable for the presence of the sign.

In no positive case was there any joint involvement either osseous or tendinous; also in all these cases the legs could be fully extended, and when the thigh was flexed the tendons became hard and tense. No case was called positive in which the angle was more than 120 degrees. The only case in which the presence of Kernig's sign might have proved misleading by resembling meningitis was one in which there were delirium, elevated temperature, rapid pulse, a red eruption over the chest and abdomen, with hyperæsthesia of the arms and legs. A leucocytic count of 5600, with positive Widal reaction, and two persons ill with typhoid fever in her home at the same time, made the diagnosis clear. W. G. Shields, Jr. (*Amer. Jour. Med. Sciences*, May, 1902).

Inability passively to extend the knee fully while the thigh is at right angles to the body—*i.e.*, Kernig's sign—is pres-

ent in over 60 per cent. of all hospital patients examined. Kernig's method is to place the patient in a sitting posture and then extend the knee. A more convenient way of applying the same test is that mentioned by Osler, in which the patient is kept recumbent and the thigh is placed at right angles to the body and then the knee is extended. A procedure having advantages over both of these methods is first to extend the knee fully, then flex the thigh on the pelvis and measure the angle at the hip. Thus only one single angle requires to be gauged instead of two, and hyperextension of the hip (showing muscular hypotonus) can be measured. There is a great proneness in meningitis to increased muscular tonus, which is most apparent in the muscles of the neck and in the hamstrings. This hypertonus, occurring in meningitis, is probably due to cerebellar irritation, and conversely cerebellar irritation is probably the explanation of Kernig's sign of meningitis. Inability to extend the knee fully with the hip at right angles to the body, or to flex the hip to a right angle while the knee is extended, occurs in many conditions besides meningitis. Among such conditions are cerebellar diseases and diseases of the upper neurons of the motor tracts; acute eye troubles; disuse of the lower limbs for some days, as in recumbency; local conditions in these limbs, as sciatica, arthritis and contractures, old age, etc. When Kernig's sign is well developed in a recently healthy individual who has fever and none of the conditions mentioned, then it is a valuable sign of meningitis, and this is probably, at least partially, in the cerebellar region. For the purposes of greater clinical accuracy it is urged that writers upon this condition express the angle at the knee or hip in degrees, rather than merely mentioning the presence or absence of the sign. R. D. Rudolf (*Amer. Medicine*, Nov. 8, 1902).

A maximum angle of 115 degrees gives more valuable results than does an angle of 135 degrees, as proposed by Kernig. The angle obtained in any individual case depends, in part, upon the force used in extending the leg, and for

this reason actual measuring of the angle is not essential. The sign is present in a large percentage of the cases of meningitis; it is, however, not constant, may be transitory, or only appear late; therefore, daily examination should be made for its presence. It is present in a typical manner, occasionally in a number of widely different disease conditions, and for this reason it is probable that there is not a uniform cause for the sign. The sign is occasionally unilateral, exclusive of cases of hemiplegia or local trouble, which might explain its unilateral presence. The presence of the sign in cases of suspected meningitis is merely another factor favoring the diagnosis. Its absence, especially early, is not infrequent, and should not be allowed to outweigh the positive findings. J. L. Miller (*American Journal Medical Sciences*, June, 1904).

A new sign of basilar meningitis. This sign consists of a rhythmical dilatation and contraction of the pupil and is invariably present, frequently as early as the fourth or fifth day, according to the severity of the attack. To obtain the sign the child's head is held between the knees of the physician with the face upward, with the body of the child supported on a bed or table. The head of the child is then grasped with each hand, and gradual and forcible extension of the head on the spinal column is made. As the head is extended the pupils will commence to dilate—the more extreme the extension the more the dilatation. Upon flexion the pupils contract, so that when the chin is forcibly brought to the sternum the pupils are closed. This can be done several times in a minute. Every time the pupillary phenomena will be repeated. G. W. Squires (*Medical Record*, Mar. 26, 1904).

The diagnosis of leptomeningitis of the vertex from the basilar form is made by the great prominence of motor involvement, and the active delirium and abnormal cerebation in the early days of the disease in cases of the former; with absence of the symptoms of cranial-nerve irritation or paralysis. As re-

marked by Osler in his "Practice of Medicine," the signs of cortical leptomeningitis cannot be separated clinically from the symptoms present at times in pneumonia and other general diseases, and due to simple congestion of the pia mater, unless there is also present some positive sign of leptomeningitis due to coincident or subsequent involvement of the cranial nerves by extension of the inflammation to the base of the brain.

The diagnosis between acute leptomeningitis, typhoid fever, or any of the acute specific fevers is made by a careful review of the history of the illness, the presence or absence of the eruptions of the various fevers, and by the presence of cranial-nerve spasm or palsy, optic neuritis, or of monoplegia or hemiplegia in cases of leptomeningitis.

From BRAIN-TUMOR the diagnosis of subacute cases of leptomeningitis may be exceedingly difficult. The two conditions may co-exist, and the same may be said of cerebral abscess, which is not infrequently associated with purulent leptomeningitis, or finally all three conditions may be present in the same case, as in a case seen by the writer in which several calcareous growths between the dura and arachnoid pressed deeply down through the post-parietal region to the lateral ventricle, into which an abscess, formed about the tumor, finally discharged. The autopsy showed an extensive cortical purulent leptomeningitis over the vertex, and its development with rupture of the abscess at the lateral ventricle was the immediate cause of death. Usually, however, in cases of brain-tumor, its symptoms are more regularly progressive, the pain more definitely localized, and the pressure-symptoms more clearly defined than is the case in leptomeningitis, while there is rarely such variations of pulse and temperature

as are commonly present in the latter affection, and optic neuritis is more common in brain-tumor.

Certain cases of URÆMIA may resemble some types of leptomeningitis. Here the careful and repeated examination of the urine, the presence of some form of œdema or dropsy, the possible presence of albuminuric retinitis, and a careful study of the previous history of the case will suffice to establish the diagnosis. Much more frequently uræmia has a clinical resemblance to brain-tumor.

Tubercular leptomeningitis may be confounded with the HYDROCEPHALOID DISEASE first described by Marshall Hall. This disease occurs in young children as a result of disease or of extremely bad conditions of life. It is characterized by intense cerebral anæmia, and the child passes through a cycle of symptoms closely analogous to adynamic cases of leptomeningitis. It often follows chronic diarrhœa. It is distinguished from the inflammatory conditions by absence of marked fever, of rigidity of the neck-muscles, and of any cranial-nerve or cortical palsies; while under treatment by stimulants, suitable food, hygiene, and tonics, the condition is often readily curable.

Differential diagnosis between syphilitic and tubercular meningitis: The latter is rare under 1 year of age; the former may occur very soon after birth. In the tubercular form paralysis seldom opens the scene, while it is often an initial symptom in the specific form. In the latter form there is often apyrexia instead of fever; the opposite condition prevails in tubercular meningitis. In specific cases the cry is rather plaintive, and differs from the true hydrocephalic cry. The pulse is often irregular, but the typical slow pulse of tubercular disease is not observed. Respiration in the specific cases is not so often affected with irregularity, and is very rarely of the Cheyne-Stokes type. The retraction of abdomen,

vomiting, constipation, delirium, contractures, peculiar posture, rapid wasting, and the munching belong more properly to the tubercular cases. Stoeber (L'Union Méd. du Canada, Aug., '91).

Distinct form of meningitis recognized, occurring almost exclusively in infants. Description of this disease is based upon eleven cases, all of which occurred in previously-healthy infants under a year old.

The onset is gradual in some, sudden in others; but, in all, the most constant and characteristic symptoms are severe vomiting, extreme head-retraction, and stupor, passing into coma, of remarkably long duration, generally several weeks,—the excessive head-retraction persisting to the last.

The cases reported all terminated fatally, none in less than five weeks, while some children lived for three months or even longer. At the autopsies inflammation of the pia and arachnoid was found over a very definite area at the basis of the brain, hydrocephalus in all the cases, and, in some, closure of the openings between the fourth ventricle and the subarachnoid space. J. W. Carr (Med. Week., Apr. 16, '97).

Tubercular leptomeningitis and TYPHOID FEVER may present very similar clinical appearances. The former, however, has retracted abdomen, constipation, normal or only slight splenic enlargement, local or general spasms or paralysis, a generally lower temperature, more frequent *irregularity* in the pulse, respiration, and temperature, and the absence of any pathognomonic eruption, to distinguish it: besides the history of the case which may aid materially in forming an early diagnosis, in cases in which no visible signs of other tubercular lesions are observed.

In typhoid the knee-jerks are altered; but the alteration is constant. They are always exaggerated, and ankle-clonus may be present. In tubercular meningitis the jerk is either absent or unequal on the two sides, or present on one side and absent on the other. Angel Money (Australian Med. Gaz., June 15, '94).

Thirty-two cases with sixty lumbar punctures. There was no unpleasant after-effect, and this was chiefly to be ascribed to the fact that the puncture was practiced with the patient on his side, and that only one case of cerebral tumor was thus treated. There were 3 cases of epidemic meningitis, 2 of which were fatal. There were seven cases of tuberculous meningitis all fatal. Lumbar puncture was here often of diagnostic value. Only twice was the tubercle bacillus found, but the fluid presented in general characteristic appearances. It was clear or only slightly opalescent, contained an increased amount of albumin, and was more or less rich in cells. In 4 cases the diagnosis of serous meningitis (Quincke) was made. The nature of a case of hæmorrhagic pachymeningitis was made certain by this procedure. In the remaining cases lumbar puncture did not assist the diagnosis, and it had no clear therapeutic effect. These cases included apoplexy, cerebral tumor, uræmia, cerebral syphilis, etc. Spinal puncture is a valuable extension of our means of diagnosis, and some therapeutic value is probable in cases of serous and sero-purulent meningitis, as well as in the cerebral disturbances of chlorosis. Thiele (*Brit. Med. Jour.*, from *Deut. med. Woch.*, June 10, '97).

Diagnosis of tubercular meningitis by lumbar puncture studied diligently in Heubner's clinic in Charité for the space of a year. Nineteen cases being observed. The bacillus was found in every instance. Negative results reported by others must necessarily have been due to imperfect technique. In three instances where the microscope did not reveal the bacillus positive results obtained by inoculation. Method was that of Quincke, whose apparatus for puncture was made use of. The operation is entirely harmless. Slawyk (*Berliner klin. Woch.*, May 2, '98).

Emphasis laid on the Skeer sign, which, when present, will enable a diagnosis of tuberculous meningitis to be made very early. It is dependent on the deposition of tubercles around the pupillary margin of the iris, showing itself first as a distinct wreath of white clouds about a

millimetre from the margin. This sign occurs before any change has taken place in the size of the pupillary orifice. After three or four days these minute cloud-like masses disappear, and a yellowish-brown circle takes their place, becoming more and more attenuated as the pupil dilates. D. R. Brower (*Brit. Med. Jour.*, July 9, '98).

The best method of making a differential diagnosis between meningo-typhus and meningitis is manifestly the Widal reaction. It is also possible, however, to detect the bacilli either by a splenic puncture or by a lumbar puncture. Other aids are the diazo-reaction, the ophthalmoscopic examination, which may reveal miliary tubercles in the choroid coat, and a marked swelling of the spleen, although when this does not occur typhoid fever is not excluded. Loeb (*Deutsches Archiv f. klin. Med.*, Feb. 9, '99).

In 13 or 14 cases in which lumbar puncture was performed at the Johns Hopkins Hospital the specific organism was demonstrated, considerable turbid or bloody fluid being frequently obtained,—as much as six ounces on one occasion. Clear fluid was sometimes obtained. Netter's conclusions objected to. Osler (*Lancet*, June 24, '99).

Etiology.—Acute leptomeningitis arises from, and is associated with, very many pathological conditions. In a certain proportion of cases the causal factor is entirely obscure and no local or general source of infection can be found. Usually, however, the disease is due to infection of the membranes with pathogenic micro-organisms, and very often the source is apparent or can be easily inferred.

The chief causes giving rise at times to acute leptomeningitis may be enumerated as follows:—

1. Tuberculosis.
2. The specific poison of the epidemic cerebro-spinal meningitis.
3. Suppurative aural or nasal disease, caries of the cranial bones.

4. The diarrhœal and dysenteric diseases of infancy and childhood.

5. The acute general diseases, — including pneumonia, erysipelas, influenza, scarlet fever, ulcerative endocarditis, diphtheria, pertussis, rheumatic fever, septicæmia, pyæmia, and possibly typhoid fever.

6. Traumatism, surgical operations, and sun-stroke.

7. The syphilitic, gouty, and rheumatic diatheses.

8. Sclerosis of the blood-vessels, miliary aneurism, embolism, intracranial tumor and abscess, and nephritis at times influence its development; and, in children especially, marasmus and poor conditions of life powerfully predispose toward some grade of leptomeningitis.

The above-mentioned conditions are all at times either predisposing or exciting causes of acute inflammation of the arachnoid. A large majority of the cases of basilar meningitis in infants and children is due to tuberculosis. Most of the cases arising from necrosis or suppuration about the head arise from necrosis of the petrous portion of the temporal bone and middle-ear suppuration. Cases also arise by infection from the nose; the infection gaining access to the ear by way of the Eustachian tube, and thence to the pia by way of the blood-vessels or lymphatics.

Epidemic of cerebro-spinal meningitis which affected children only. There were forty-three cases in a total population of about two hundred and fifty people. Origin of the epidemic was traced to the village-school, where it was learned that a few weeks previously a number of the children had been affected with a sharp diarrhœa. The same children affected with meningitis had been victims of the preceding diarrhœa. Disinfection and closing of the school temporarily caused a cessation of the epidemic. Monk (Brit. Med. Jour., July 30, '92).

Tubercular meningitis in children, is, in all probability, always secondary in its cerebral development to a primary focus elsewhere, and not idiopathic. Simon (Revue Men. des Mal. de l'Enfance, June, '93).

Cerebro-spinal meningitis is practically an autoinfection from the micrococcus lanceolatus, which, ordinarily innocuous and normally present in the mouth, is rendered virulent by extraneous causes which chemically alter the bodily secretions. Flexner and Barker (Johns Hopkins Hosp. Bull., June, July, '93).

Seven cases of pseudomeningitis, six fatal, without anatomical lesions, following an epidemic of influenza. Krannhals (Deut. Archiv f. klin. Med., Dec. 20, '94).

In 60 to 70 per cent. of recorded cases of cerebro-spinal meningitis Fränkel's diplococcus lanceolatus found. Out of ten cases, two in which there was definite pus-formation, diplococci present in enormous numbers; in those in which only fibrinous exudation existed microorganisms scantier and found inside the nucleus of the cells. The "diplococcus intracellularis" the true cause of epidemic cerebro-spinal meningitis. Jaeger (Zeit. f. Hyg. u. Infects., B. 19, H. 2, '95).

Bacteriological examination of the meningeal exudate in a case of cerebro-spinal meningitis showing, in the pus-cells, a special diplococcus distinguished from that of Fränkel by a globular form and a frequent disposition in fours, by its not staining by Gram's method, and by the difficulty of causing infection in animals when subcutaneously inoculated. Kischevski (La Méd. Mod., Jan. 8, '96).

Although the organisms are much alike, the meningococci vary more in size among themselves than the gonococci. The arrangement in the cells is much alike in both cases. Both decolorize by Gram's method. The meningococci, however, grow rapidly in glycerin agar: a fact of great value in the diagnosis of cerebro-spinal meningitis by the aid of spinal puncture. It was impossible to inoculate guinea-pigs and rabbits, but, while carrying on the observations, the operator had rhinitis, with marked depression, headache, nervousness, and a drawing pain in the neck. The pus from

the nose showed cocci similar to those in the cultures and these soon overcame the other bacteria of the nose, appearing almost in pure culture. F. Kiefer (Berliner klin. Woch., No. 28, '96).

Case of epidemic cerebro-spinal meningitis in a girl, aged 2½ years, terminating in recovery at the end of thirty-four days. Lumbar puncture was made and the cerebro-spinal fluid gave a pure culture of the intracellular meningococcus (Weichselbaum-Jaeger), which, according to the researches of Heubner, should be considered the specific cause of epidemic cerebro-spinal meningitis. Stoelzner (Berliner klin. Woch., No. 16, '97).

The pneumococcus and meningococcus are the chief producers of cerebro-spinal meningitis, and other micro-organisms, especially the pyogenic cocci, play the causative part in only a few cases. In circumscribed meningitis the pneumococcus has, up to the present, alone been found. A general infection by way of the blood must be distinguished from a local infection arising from some region in the neighborhood of the skull. One of the most frequent modes of infection is the micro-organisms gaining access from the naso-pharynx through the Eustachian tube into the middle ear, and thence into the cranial cavity. Wolf (Berliner klin. Woch., Mar. 8, '97).

Case of rapid death after labor from infectious meningitis from the pneumococcus. Crouzat (Rev. Obstet. Internat., Apr. 21, '97).

Epidemic cerebro-spinal meningitis is to be classed among the contagious diseases, belonging to the same category as phthisis pulmonalis. Unsanitary conditions exert great influence in affording a proper *nidus* for the growth of the germs of this disease. William J. Class (Med. News, Dec. 3, '98).

One hundred and eleven cases of epidemic cerebro-spinal meningitis examined. Conclusions are as follow: Epidemic cerebro-spinal meningitis is an acute infectious disease produced by a micrococcus characterized by its growth in pairs and by certain cultural and staining properties. The seat of the disease is the meninges of the cord and brain. It is

possible that the nose is the portal of entry. There is an acute purulent inflammation in the pia-arachnoid. The cortex is affected by extension. The cord is always affected. The organisms are found in considerable numbers in the majority of acute cases. The surest method of diagnosis is by spinal puncture. In the early stage a fluid more or less clouded by pus-cells, containing the organisms can be found.

There are no prodromata; there is vomiting and pain in the head. In most cases there is pain, stiffness, and muscular contraction of the neck. There is usually delirium, and in many cases unconsciousness passing into coma. Paralyzes are common. Councilman, Mallory, and Wright (Report State Board of Health of Mass., '98).

The disease of infancy, recently described as simple or non-tuberculous posterior basic meningitis, is a specific disease, due always and only to a particular micro-organism. The micro-organism which is the cause of this disease is a diplococcus almost identical with the diplococcus described by Weichselbaum and Jaeger; it presents, however, some slight differences, which are probably to be accounted for by natural variation.

The simple posterior basic meningitis of infants must, on bacteriological evidence, be considered as a sporadic form of the disease known as epidemic cerebro-spinal meningitis, the *D. intracellularis* having been shown by recent observers to be the cause of some, at least, of the epidemics of that disease. The peri-arthritis, which occasionally complicates posterior basic meningitis of infants, is due to the same diplococcus that is found in the meningeal exudation. G. F. Still (Jour. of Path. and Bact., volume v, p. 147, '98).

Case of boy of 13, who for several days presented all the clinical signs and symptoms of tuberculous meningitis. The boy then passed seven worms and all the symptoms disappeared instantly.

Another case of a boy of 7, who also presented all the symptoms of tuberculous meningitis. An emetic was given, then calomel and santonin, which brought out several worms. Nevertheless the con-

dition of the child continued to grow worse, the meningitis took its regular course, and the child died. Duchesne (*Jour. de Méd. et de Chir. Prat.*, 24, VI, '98).

Series of 17 cases of posterior basic meningitis. In 12 the diagnosis was confirmed by autopsy. The bacteriological examination in 9 instances showed that in 8 of these an intracellular diplococcus was present in the exudate. Seven of the cases occurred in females, 10 in males. The average age was nine months, excluding 4 cases which occurred in their fourth year and over. The onset of the disease was marked by retraction of the head in 3 cases, vomiting in 9, convulsions in 4, and bulging of the fontanelles in 6 cases. Sooner or later retraction of the head appeared in all of the cases. Of the ocular symptoms there were frequently noted early strabismus and nystagmus. In 13 out of the 17 cases changes in the fundus were observed, and amaurosis was seen in 7 cases. Retraction of the upper lid, which occurred in 7 instances, is regarded as the most constant and characteristic ocular symptom of posterior basic meningitis. Vomiting and rapid progressive emaciation were present in all of the cases. A clinical feature, sometimes present in posterior meningitis, is hydrocephalus, and involvement of the joints. Leucocytosis was found in the more acute form, while in the chronic variety the number of leucocytes was normal. Thursfield (*Lancet*, Feb. 16, 1901).

Pathology.—The post-mortem appearances in cases of acute leptomeningitis differ according to the stage of the inflammation at which the patient dies, and the character of the exudate especially is influenced by the duration of the disease. In some of the very malignant cases of cerebro-spinal meningitis intense hyperæmia of the membranes may be alone observed by the naked eye, death having occurred before the exudate had time to form. In the majority of cases, however, very marked lesions

are found, with copious exudate of serum or pus, and accompanied by more or less acute hydrocephalus, especially in tubercular cases, with some degree of ventricle dilatation. Quite frequently the ependyma is found involved, and, less frequently, the brain-substance subjacent to the affected area is also the seat of inflammatory and degenerative changes, due to direct extension of the inflammatory process, and to the pressure exerted upon it by the meningeal exudate. The exudate found in these cases varies very much in color and consistency, from an almost colorless serous exudate to whitish-grayish or greenish, gelatinous pus. In cases dying before exudation can occur, the pia-arachnoid often presents large areas of brilliant-red hyperæmia. This condition may involve the entire cortex, or be unilateral, or may be chiefly at the base, with scattered patches elsewhere over the surface of the meninges. In such cases the patient undoubtedly succumbs to an intense general toxæmia, rather than to any influence produced by the local lesions within the cranial cavity. The ventricles are most frequently dilated in the tubercular cases, although in many other types of the disease this lesion is also found. When the disease is chiefly cortical or over the convexity of the brain, it is most commonly most intense over the fissure of Sylvius and over the motor convolutions. In some cases numerous opacities of the pia are present, scattered throughout the base and lateral regions of the brain, and less frequently over the cortex. About these may be collections of turbid yellowish serum, shreds of lymph, or various types of pus. In cases of long standing the pus may undergo caseation, with partial absorption of its fluid, and leave a yellowish, caseous mass upon the thickened and degenerated membranes.

At the base all of these appearances may include or cover the sheaths of the cranial nerves, and often the nerves themselves are found softened and broken down. Some writers have laid stress upon a purely-serous variety of acute leptomeningitis in which there is, in addition to large ventricle, effusion or exudate of serum between the dura and the arachnoid, contained in a thin pseudomembranous new formation. Reference to this condition will be found under the remarks upon ACUTE HYDROCEPHALUS. Cases of purely-serous leptomeningitis running an acute course are extremely rare.

The great majority of cases show some degree of purulent exudate, sometimes admixed with coloring matter from the blood in severe cases of the epidemic cerebro-spinal form. Sinus-thrombosis is quite frequently found in cases arising from aural disease, sometimes associated with abscess.

In tubercular leptomeningitis of the basal membranes in infancy and childhood the exudate is frequently thick and gelatinous, while the pearly-grayish tubercles can usually be seen by the naked eye along the course of the vessels, and scattered throughout the membrane. The deposit of tubercle at the base commonly occurs over the position of the optic, olfactory, and third nerves and the crura cerebri. It may include any of the cranial nerves. In adults miliary tubercles are frequent over the cortical areas, while in children the cortex is only rarely involved. Tuberculosis of other organs in the body is usually found.

In cortex cerebri in tubercular meningitis, as shown by the fresh method of examination, are found just under the meninges, very small round cells and also numerous flask-shaped cells which give off many fine processes, forming a mesh-work with neighboring cells. These cell-

processes cannot be traced deeper than the third layer of cortical cells. The minute vessels are dilated. In many specimens the nerve-cells of the second and third layers are stunted and atrophied, often only the nucleus being left. As these degenerated nerve-cells are always in close contact with the spindle-cells, which are probably to be looked upon as scavenger-cells, it appears that the degenerate nerve-cells are taken up by them. Goodall (*Brain*, Summer and Autumn, '91).

Case of a child suffering from typhoid fever, which had begun with disturbance of the stomach and torticollis. The course of the disease had been characterized by high fever, ranging for a time between 104° and 105.4° F. (40° and 40.7° C.). Early in the course of the disease the attending physician had observed a rigidity of the neck, but owing to the absence of Kernig's sign had dismissed the thought of meningitis. Several days later, when the writer saw the patient, the symptoms of meningitis were quite distinct. Lumbar puncture gave issue to a serous fluid which was found to contain typhoid bacilli. The case terminated fatally. Guinon (*Soc. de Pédiatrie*, Séance, Oct. 8, 1901; *Revue Men. des Mal. de l'Enf.*, Nov., 1901).

The post-mortem appearances of epidemic cerebro-spinal meningitis of ordinary type are those of wide-spread acute hyperæmia, inflammation, and exudation, involving the meninges of the brain and spinal cord. The brain is engorged with blood, the veins are distended, and the membranes hyperæmic and inflamed. The spinal cord is in the same condition. The exude is sero-purulent or purulent, and grayish or yellowish in color. Sometimes it is abundant over the upper portions of the hemispheres. The pus often extends down to the extremity of the spinal cord (being more abundant in patches usually), and the whole cord may be evenly surrounded by pus. There are patches of thickening, and adhesions are

found between the pia and the cortex in cases of some weeks' duration. The ventricular fluid is increased, but not to the extent common in tubercular leptomeningitis. Rarely, areas of capillary hæmorrhage and encephalitis, with softening, are found in the cerebral substance, and an abscess may be associated. The spleen is usually enlarged. Among the complications recorded by various writers are pneumonia, pleurisy, pericarditis, endocarditis, and acute nephritis.

The microscopical appearances of epidemic cerebro-spinal leptomeningitis include minute capillary hæmorrhages in the pia of the brain and cord, distended vessels with masses of leucocytes swelling their sheaths, granule-cells and red and white blood-corpuscles infiltrating the cortical layer of brain and cord, and degenerative changes in the cells of the spinal and cerebral nerves, especially in the posterior spinal nerve-roots.

The infecting micro-organisms of leptomeningitis are the streptococcus pyogenes, the bacillus communis coli, the intracellular diplococcus of Weichselbaum, the staphylococcus pyogenes aureus, the tubercle bacillus, and the micrococcus lanceolatus or pneumococcus. The pneumococcus is now generally regarded as most closely associated with epidemic cerebro-spinal meningitis. According to Putnam, the symptoms of leptomeningitis are partly due to the absorption of toxic ptomaines formed by the micro-organisms, the other factors being the pressure of the exudate itself, and the direct pathogenic micro-organisms upon the meninges of the brain.

Case of child, 6 weeks old, previously healthy, with the exception of a cough for a few days preceding. Upon auscultation crepitant râles were audible, fairly uniformly distributed. Diagnosis of acute bronchitis was made. A few days later the child was seized with violent

convulsions and vomiting, passing into a semicomatose condition, and died. Purulent meningitis most marked on the vertex. No tubercles were present, the lungs were free from pneumonia, except for two small areas of congestion at the right base. The meningeal fluid contained abundant pneumococci. Ferrand (*La Méd. Mod.*, July 8, '96).

The meningococcus behaves differently for different observers upon the ordinary culture-media, although in general it can be said to lose its vitality quite readily. It is not at all certain that the organism is really not a variety of the pneumonia. The pathological anatomy of the disease includes more or less bronchitis and hyperæmia of the lungs, with occasional areas of pneumococcic infiltration; ecchymoses in the endocardium and pericardium, with slight alteration of the heart-muscle; a small spleen, often with a wrinkled capsule. The liver is hyperæmic and darker in color. The urine often contains albumin and casts; and the kidneys are intensely hyperæmic and there is parenchymatous degeneration of the cortex. Sometimes swelling of the solitary follicles of the intestine and of Peyer's patches has been observed. Mayer (*Münch. med. Woch.*, Aug. 30, '98).

Prognosis.—The prognosis of all forms of acute leptomeningitis is very grave. That of the simple purulent and sero-purulent types, whether in infants or adults, is grave, but should always be guarded, owing to the many difficulties in the way of a positive diagnosis. The outlook in the tubercular form of the disease is wholly bad, notwithstanding the fact that a few cases have been reported in which complete recovery is stated to have occurred.

Case of tubercular meningitis in which the diagnosis was established beyond a doubt, followed by recovery. Fürbringer (*Deut. med. Woch.*, No. 36, '94).

With the very rarest exceptions, an attack of tubercular meningitis terminates in death. In other forms of meningitis death often occurs, but recovery is more frequent than in the tubercular

form. D'Arcy Power (Clinical Jour., May 20, '96).

Two cases of meningitis, apparently tuberculous in nature, with recovery. George N. Acker (Medical News, May 29, '97).

Cases of localized or unilateral leptomeningitis in which it is possible to remove the cause by surgical operation offer hope of recovery. This applies chiefly to traumatic cases, and to some of the cases arising from suppurative aural inflammation. The syphilitic type usually yields to prompt and energetic treatment.

In cerebro-spinal leptomeningitis, whether of sporadic or epidemic variety, the prognosis, while very grave, always admits of hope that the disease may prove abortive and recovery take place. A fair percentage of such cases recover from apparently hopeless conditions, and while the recovery may be, at times, very rapid and satisfactory, more often it is slow and protracted. In cases in which the exudate is serous, absorption may take place, and if the effusion has not been excessive in amount the brain may recover from the effects of the increased intracranial tension, and the consequent dilatation of its ventricles. The mortality of the epidemic cerebro-spinal form is greatest during the first half of the period of the epidemic, many more recoveries being recorded in the later weeks of its prevalence. Malignant cases of this disease die sometimes within a few hours after being stricken with the early disease.

A pneumococcic meningitis is rarely recovered from, the fatal result occurring in a few days. In epidemic cerebro-spinal meningitis, on the other hand, only one-third to one-half of the cases die. The recognition of this form of meningitis by the help of spinal puncture is of considerable importance. Heubner (Deut. med. Woch., July 2, '96).

During the winter and spring of 1897 an epidemic of cerebro-spinal meningitis occurred in Massachusetts; 47 cases were treated in the Boston City Hospital. The mortality in these 47 cases was 72 per cent. Lumbar puncture was performed in a large proportion of these cases, and in most of them the diplococcus intracellularis meningitidis of Weichselbaum was found in the cloudy serum of pus obtained. Editorial (Boston Med. and Surg. Jour., Dec. 30, '97).

It is impossible to say how long an epidemic of cerebro-spinal meningitis will last or what the termination will be in a given case until the lapse of a considerable interval of time during which the patient is free from symptoms. In chronic cases the mortality is estimated to be fully as high as in the acute variety. The mortality varies very much in different epidemics. Hirsch estimates it at from 20 to 70 per cent. A. H. Wentworth (Lancet, Oct. 1, '98).

In all cases of leptomeningitis the early occurrence of stupor, coma, or severe convulsions are bad omens; and high fever during the first weeks is always an unfavorable sign. In many cases of acute leptomeningitis, especially when the disease occurs in infants or young children, remissions in the severe symptoms are common from about the fourth to the tenth day, but too often the improvement is but temporary. When this marked remission occurs, it is probably due to the fact that in children the primary shock to the brain is greater than in adults, and, as the brain becomes accustomed to the increased pressure due to congestion and exudate, its functions are reasserted for the interval of the remission, only to be overcome again as the disease progresses and the effusion increases. Recovery from acute leptomeningitis is only rarely perfect, for usually some permanent defect remains as a sequel. These sequelæ may be mental, sensory, or motor in character, depend-

ing upon the location, severity, and extent of the inflammation.

Treatment. — The treatment of acute leptomeningitis will depend greatly upon its cause, but aside from those cases originating in diathetic states of the body (such as the rheumatic, gouty, or syphilitic), or those of traumatic or septic origin in which surgical measures may be advisable, the generally-accepted treatment of all cases is mainly symptomatic. The cases due to the general diatheses above referred to should, of course, receive appropriate treatment to counteract them, in addition to the other measures necessary to combat the inflammation.

All varieties of acute leptomeningitis demand a quiet, well ventilated and darkened room, and an intelligent, capable nurse. The patient should be put into conditions of the most perfect mental and physical rest obtainable in the case. All noise, bright light, and unnecessary conversation should be excluded. The food should be nourishing, easily digestible, and given at regular intervals, for special attention must be paid to the stomach in all of these cases, since vomiting is so frequently a decided symptom of the disease. The chief indications during the first week are to relieve pain and procure rest and sleep; to lessen the amount of blood within the skull; and, in some cases, to reduce the general bodily temperature.

In the case of a soldier unconscious from cerebro-spinal meningitis lumbar puncture made between the second and third lumbar laminae, about one drachm of clear fluid being withdrawn. This was done to relieve the pressure and for diagnostic purposes. The patient recovered completely. Notwithstanding the fact that the opening between the cranium and spinal cord is obliterated in some cases, the operation of lumbar puncture should be performed before the

more serious operations of trephining the cranium or dorsal laminectomy. W. Cuthbertson (Chicago Med. Recorder, June, '99).

Technique of lumbar puncture: There are three chief requirements to be considered: 1. That the needle shall find ready entrance to the subarachnoid space. 2. That the tapping be made at the point least likely to admit of damage to the nervous structures of the canal. 3. That the fluid obtained shall be as rich as possible in sediment. The first requirement is sufficiently well met by entrance through any of the lumbar spaces or through the lumbo-sacral space. Possible injury to the cord can be excluded by entering at some point below the third lumbar vertebra. In adults it is perfectly safe to puncture between the second and third vertebræ. The last requirement is best fulfilled by tapping in the lumbo-sacral space. L. A. Conner (N. Y. Med. Jour., May 12, 1900).

Possibility of death following lumbar puncture. An accident which is very liable to happen, and to which little attention has been drawn, is the breaking of the needle by some movement of the patient or doctor. In searching through the literature the author finds fifteen cases of sudden death, following tapping of the spine. He reports two cases from his own experience. F. Gumprecht (Deut. med. Woch., June 14, 1900).

For the relief of pain morphine, hypodermically, is, perhaps, the best means. It should be given in doses large enough to produce the required effect. Chloral and the bromides are valuable adjuvants, and they also do good in allaying motor spasm, and the excessive irritability of the nerve-centres. In very young children and in the aged, chloral should be used with some caution, owing to its action upon the heart. The cephalic and spinal ice-bags are also valuable in relieving pain, and at the same time limit the fever. When the patient's hair is abundant the scalp should be shaved. When the asthenic stage is reached, they should be used with caution, for they

may depress very young children to the point of collapse.

For the purpose of lessening the intracranial congestion and limiting the inflammation as far as possible, bleeding has been practiced, but is only proper in young, strong, and otherwise healthy adults. It should never be employed in children or the aged. Dry cupping is valuable and does not exhaust the vitality of the patient. They may be applied to the back of the neck, temples, or behind the ears, and even in cases where general blood-letting is not contra-indicated they are extremely useful in relieving pain and allaying restlessness. Leeches are employed at times.

In chronic hæmorrhagic leptomeningitis, blisters and galvanism to the head (1 to 5 milliamperes) recommended. Lombroso (Centralb. für Nerv. Psychi. u. gericht. Psychop., Apr., '92).

Treatment of case of tubercular meningitis which recovered consisted in ice-bags to the shaved head, poultices over the whole body up to the neck, leeches to the septum of the nose, and potassium iodide, internally, in doses of at first 2 drachms daily. The drug was borne without serious effects. Janssen (Deut. med. Woch., No. 11, p. 169, '96).

When insomnia is persistent sulphonal or trional may be used; or a combination of morphine, chloral, and bromide of potassium, which also helps to control muscular spasms. Hydrobromate of hyoscine is recommended by J. M. Da Costa for the control of muscular spasm. For the severe muscular pains of the epidemic cerebro-spinal disease Roland G. Curtin advises phenacetin as the safest and most efficient of the antipyretics. Weakness is a contra-indication to its use. Mustard plasters or liniments may also be employed for the same purpose.

Result of hot baths in cerebro-spinal meningitis. Case of man, of tuberculous aspect, who suffered from severe cerebro-

spinal meningitis. Hot bath was given and was followed by a slight amelioration of the general condition, improvement becoming more marked after each successive bath, until, by the time the eighth had been given, recovery was about complete. In a second case condition of patient was even more serious, owing to cardiac asthenia, and the result was equally satisfactory. Baths were given daily at a temperature of 104° F. and ten minutes' duration. Vorochilsky (Russkaia Med., No. 4, '95).

In cerebro-spinal meningitis value of hot packs emphasized. The hot cloths are applied for three-fourths to one hour. The rigidity of the neck and hyperæsthesia particularly diminish under this treatment. Schlesinger (Münch. med. Woch., Oct. 27, '96).

Five cases of cerebro-spinal meningitis successfully treated by hot baths. The temperature of the daily bath varied from 99.5° to 104° F. M. Jewnin (Ther. Monats., H. 11, S. 581, '96).

Seven cases of cerebro-spinal meningitis treated by hot baths, of which 5 completely recovered.

Of the deaths, one was a *foudroyant* case, which died within forty-eight hours; the others were in the late stage of the disease, the baths being employed only during the first two weeks.

The method is as follows: The patient is placed in the bath at the temperature of 90.5° to 92.75° F., and hot water gradually added until 104° F. is reached. While in the bath an ice-bag or a Leiter cold-water coil is placed upon the head.

If there is great tenderness of the back, the sheet may be used to move the patient. The bath must be previously cushioned and thorough after-drying omitted. The patient is placed upon a dry sheet, laid upon a woolen quilt, and covered by the same, over which a light cover is placed; he remains in this position for one hour before removal. The time of the bath is immaterial—early morning or late evening. Nourishing food, even meat, should be given; even diarrhœa, should this occur, does not contra-indicate it. Wine, brandy (in milk), and also beer, are given. Alfred Wolisch (Ther. Monats., H. 5, '96).

When the pyrexia needs to be controlled, the spinal ice-bag, in addition to the ice-cap, is valuable, and may be supplemented by cool sponging. If more decided measures are needed small doses of antipyrine or acetanilid answer the purpose. Aconite and veratrum viride are used at times in the first days of the disease, for the purpose of quieting the circulation.

Remedies given to directly influence the inflammation are mercury and the iodides. The former may be given preferably in the form of calomel, in small doses frequently administered upon the tongue, as early in the disease as possible. The iodides are of more service during the later stages to cause absorption of the exudate. Both are valuable remedies, and have received the indorsement of the highest authorities. They may be combined with other remedies, for it is desirable to disturb the patient as little as possible.

Those cases arising during the course of acute bowel disorders in infancy demand the removal of the poisonous matter contained in the bowels as an initial step in the treatment, and for this purpose irrigation of the bowels should be employed.

Case of acute simple meningitis cured. He was treated freely with mercury under the direction of Broadbent. J. J. Clark (Brit. Med. Jour., June 8, '89).

Good results from mercury in nine cases of cerebro-spinal meningitis occurring in an epidemic of grip. Only one case proved fatal. Dose varied from $\frac{1}{15}$ to $\frac{1}{7}$ grain of the bichloride, according to the age of the patient, administered hypodermically once in twenty-four hours in the beginning and later once in forty-eight hours. Consalvi (La Sem. Méd., Jan. 15, '96).

Uniform success with mercury in cerebro-spinal meningitis; $\frac{1}{4}$ grain of mercuric chloride is given hypodermically at first and then $\frac{1}{15}$ grain every hour

until there are symptoms of gastrointestinal irritation. Smith (Jour. Amer. Med. Assoc., June 13, '96).

Method of Dazio in treating meningitis with hypodermic and intravenous injections of mercuric chloride successfully employed. Dinami (La Pediatria, Nov., '97).

Case of tuberculous meningitis in which recovery followed the use of creasote in liberal doses. The diagnosis was confirmed by Professors Gerhard and von Michel. The patient was a male, aged 20, whose parents had died of tuberculosis and who had been cauterized for local tuberculous processes of the tonsils, tongue, and neck. For several years the patient suffered from an incurable fistula *in ano*. During the progress of the case tubercles were found in the choroid of the left eye. Creasote was administered from the beginning of the attack in increasing doses, until the daily quantity, $4\frac{1}{2}$ grammes ($1\frac{1}{8}$ drachms), divided into three doses and given in capsules, was reached. In addition to the use of creasote the treatment relied on in this case was chiefly the administration of potassium iodide and the painstaking nourishment of the patient. Chaumier regards creasote as valuable in these cases only if given in doses of at least 2 grammes (30 grains) daily, and only then if combined with out-door treatment. Burlureaux recommends the injection of creasote in increasing doses up to 5 grammes ($1\frac{1}{4}$ drachms). The writer places the limit at the point of toleration and remarks that creasote is found in the blood-serum in proportion to the dose given. Not only the daily quantity, but the individual dose, should be as large as possible inasmuch as the drug is very rapidly eliminated. Thomalla (Berliner klin. Wochen., June 16, 1902).

The surgical treatment is limited to those cases of simple purulent leptomeningitis in which the disease is localized and accessible to the trephine. Among American surgeons Senn and Keen advise trephining in tubercular cases and washing out the exudate with antiseptic

solutions. Cases arising from aural and mastoid suppuration may require surgical measures. It should be remembered that the inflammation in such cases is sometimes on the opposite side of the brain, as in a case referred to by Charles K. Mills in his work on nervous diseases. In such cases special study must always be given to any localizing signs present. Lumbar puncture has been practiced by Quincke in cases of serous leptomeningitis, both for diagnostic purposes and the relief of intracranial tension.

Lumbar puncture employed in 25 cases, including 19 of tuberculous meningitis. In no case as yet has the puncture produced a cure. A fatal result occurred in all 19 cases of tuberculous meningitis. No improvement seen in the optic neuritis. Lumbar puncture can only be of very limited diagnostic value in tuberculous meningitis. The differential diagnosis between it and the meningitis consecutive to ear disease has not always been made easy by spinal puncture. In tuberculous meningitis the fluid drawn off is clear, usually colorless, but it may be very slightly green or yellow. The specific gravity was about 1010, and the amount of albumin 1 to 1.5 *pro mille*. Traces of sugar were present. The amount of fluid drawn off was usually from 20 cubic centimetres to 30 cubic centimetres, and the pressure high, amounting to 160 millimetres to 300 millimetres water. V. Ranke (Münch. med. Woch., Sept. 21, '97).

Treatment of cerebro-spinal meningitis by repeated lumbar puncture using the Quincke method and from 3 to 50 cubic centimetres ($\frac{3}{4}$ to $12\frac{1}{2}$ fluidrachms) of the fluid was withdrawn. The punctures were made on 5th, 6th, 8th, 9th, 10th, 13th, 16th, 19th, 24th, 28th, 36th, and 37th days of the disease. The fluid withdrawn on the 5th day was turbid; on the 6th, cloudy; on the 8th, turbid; 10th, turbid and flaky; 13th, turbid, thick, and purulent, and continued to be turbid up to the 37th day. Micro-organisms were found in turbid, opalescent, and less turbid fluids. In opalescent or clear fluids they were found by staining

and sometimes were absent by culture. Such symptoms as persistent headache, somnolence, coma, delirium, and convulsions due to an accumulation of fluid and pressure about the brain and cord, and to a certain amount of toxæmia resulting from the absorption of inflammatory products were relieved temporarily by the puncture. The puncture was carried out with antiseptic precaution, most of the patients receiving three punctures, although in one more were given. The operation was only performed when symptoms of pressure or accumulation of exudate appeared, and the procedure was only repeated if there was an exacerbation of the symptoms. There seemed to be no marked effect on the pulse and respiration, even if a considerable amount of fluid was withdrawn. H. Koplik (Medical News, March 23, 1901).

Only three cases are reported but the results have been so striking that a report at this time is justifiable in view of the fact that the prognosis is so unfavorable. The treatment consists of lumbar puncture and the withdrawal by aspiration of varying quantities of spinal fluid, frequently amounting to 50 cubic centimetres. Artificial serum is then injected with the same syringe. Lastly a quantity of 9 to 12 cubic centimetres of a one-per-cent. solution of lysol is injected through the same instrument and the needle withdrawn. The temperature falls immediately, but rises again after one to three days, when the puncture and injections are repeated and so on until only quite clear and limpid fluid is withdrawn after puncture. Of the three cases reported the first was a meningococcus infection and the second a virulent streptococcus. It is an open question whether the meningococcus case would have recovered without this treatment, yet the fact remains that the patient was losing ground steadily, in spite of the various treatments, including lumbar punctures. After the first injection he rapidly improved, and the second was followed by a rapid and uneventful recovery. M. Manges (Medical News, May 14, 1904).

Chronic Leptomeningitis (Cerebral).

Definition.—Chronic cerebral leptomeningitis is a chronic inflammatory affection of the pia arachnoid, associated with a great variety of clinical symptoms, according to the location, extent, and grade of the inflammation. The dura and brain-substance are very frequently coincidentally affected.

Varieties.—This disease occurs in the large majority of cases in patients past middle life, but an infantile form is described by Gee and Barlow and others in which the posterior fossa is usually the seat of the inflammation. In location the disease may affect any portion of the membranes, but its most frequent site is the vertex. The exudate found in such cases may consist of serum, pus, lymph, or dense connective tissue.

The chief clinical varieties are: 1. A very numerous class of the chronic insane. 2. Cases following chronic alcoholism, syphilis, tuberculosis, and gout. 3. Infantile cases arising from acute leptomeningitis, inherited syphilis, or tuberculosis. The chief causes of all cases are syphilis, tuberculosis, chronic alcoholism, traumatism, sun-stroke, and previous attacks of congestion or inflammation of the arachnoid.

Symptoms.—The symptoms of chronic leptomeningitis will vary almost indefinitely, as already remarked, with its location, extent, and severity, and the general condition of the patient affected. The symptoms noted in infantile cases have been stupor of some grade, occasional vomiting, headache; rapid, irregular, or slow pulse; diplopia, strabismus, ptosis, irregularity of the pupils, and slight fever. In some cases active vomiting, decided fever, cervical opisthotonos, and spastic limbs, with occasional convulsions, have been recorded. There may be hemiplegia or bilateral paresis or

paralysis. The face is sometimes involved alone. All the signs are developed with great irregularity, and the disease runs a very irregular course throughout.

Chronic leptomeningitis is far more frequently seen in male adults, and in old age, and especially among the insane it is a very frequent post-mortem finding. The symptoms observed during life may be any form of chronic mental disease, but it is particularly common in general paresis, chronic mania, and in terminal dementia following all forms of insanity. The exact relationship of the lesions of chronic leptomeningitis found so often in insane subjects is still a matter of some doubt, regarding their importance as causes of the mental disorder. Certain forms of chronic leptomeningitis are undoubtedly merely an evidence of the wide-spread degeneracy of the vascular system, and of the very low general vitality of all the tissues of the body.

In some cases following traumatism this lesion is probably the physical cause of the symptoms observed during life. The blow upon the head which causes chronic inflammation of the membranes is more frequently not attended by fracture, but, from the history given, has been sufficiently violent to cause unconsciousness. Months or even years may elapse before definite cerebral symptoms occur. When they develop they may simulate almost any form of insanity, but, during the course of the disease, the mental symptoms are apt to be variable and irregular, when compared with typical cases of the kind simulated by the traumatic affection. Some form of paresis or paralysis may occur early or late, but is not constant. Pain in the head is the most constant feature, and if this occurs for weeks associated with mental depression or exaltation and a history of

traumatism of the vertex of the skull, chronic leptomeningitis may be suspected at the point of injury.

The traumatic cases are, however, very few in number compared with the great frequency of the lesions of chronic leptomeningitis in hospitals for the insane. The importance, however, of the recognition of the traumatic cases has led me to mention it prominently, and to lay stress upon its occasional occurrence without definite localizing symptoms; because very frequently the prefrontal or the post-parietal region is the site of the injury, thus giving us few motor symptoms, unless the process extends beyond the limits of the original traumatism.

The clinical history of cases of chronic leptomeningitis may present signs of either basal or vertical origin, or focal symptoms may be present, especially in the syphilitic cases. The symptoms do not depend upon the character of the cause producing the trouble, but simply upon the local lesion and its location, intensity, and extent. There is no definite clinical picture to present, and the symptoms noted are those common to several other conditions. It is only when considered in connection with the history of the case and with their mode of development and course that they can point with any certainty to this disease. The symptoms in adults or old age include persistent headache, usually dull and aching, but at times complained of as sudden shooting pains through the head, and in other cases it may be localized dull and boring; rapidly increasing debility, with loss of flesh in the old, with or without paresis of the limbs; profound mental depression, or stupor, or mere apathy or varying degrees of mental exaltation, in younger subjects especially; attacks of vertigo or syncope; occasional

attacks of causeless nausea and vomiting; optic neuritis may be present, but is often absent; more decided symptoms may exist when the cortex itself is involved, as in a case reported by Mills, presenting "athetoid spasm, myotomia, and diffuse bilateral disturbances of sensation, which was found to be due to chronic convexity, meningitis of both hemispheres with cortical and subcortical softening, the lesion being most marked in the postero-parietal region." This case also had recurring attacks of Jacksonian epilepsy. It is impossible within the limits of this paper to give more than the merest glimpse of the wide range of symptoms which occur in these cases of chronic leptomeningitis. Fully one-half of the cases are secondary to other affections of the brain or to the bodily manifestations of one or other of the diatheses already referred to as etiological factors. Thus, its symptoms may complicate those of brain-tumor or brain-abscess, traumatism, embolism and thrombosis, and cerebral atrophy; or they may arise in the course of general tuberculosis, or as the tertiary stage of syphilis.

Etiology.—Chronic cerebral leptomeningitis arises (1) in infancy or childhood from inherited disease or an acute attack drifting into a chronic condition, well described by Gee and Barlow. (2) Certain other cases may arise acutely, including the traumatic type of the disease, which can quite frequently be traced directly to a definite injury at the position of the lesions found post-mortem. (3) The largest number of all cases in adults are due to structural alterations dependent upon antecedent syphilis, tuberculosis, chronic alcoholism, rheumatism, and gout, and a large proportion of the cases become insane at some stage of the disorder.

The view is now quite commonly held that infection occurs in these cases as the causative factor. This is, however, by no means proved, and is largely conjectural.

Pathology.—The post-mortem appearances vary a great deal according to the duration of the disease and the nature of the inflammation.

Tuberculosis chiefly affects the base, although its lesions may appear anywhere else over the surface of the hemispheres. The syphilitic lesions appear as more or less cheesy, gummatous, or fibroid lesions which at times invade the cortex. When the inflammation is of a simple character most of the lesions are of connective-tissue deposits in the pia and especially noticeable in their effect upon the blood-vessels, which may be greatly thickened and even obliterated in areas.

When the cases are of less duration the exudate may be pus or sero-purulent matter mixed with poorly-organized patches of lymph. Cases are numerous in which the cerebral membranes are closely matted together by connective-tissue adhesions, and in such cases the dura may be firmly adherent to the skull and the pia less firmly to the brain-substance. The choroid plexuses and the ependyma frequently show marked lesions, and at times are covered by a lymphatic or purulent exudate. The veins are commonly overdistended with blood, but in long-standing cases, in which there is almost always a marked atrophy of the brain, a compensating œdema of the membranes is usually present, and this serous exudate may be so abundant as to exert sufficient pressure upon the blood-vessels to empty them and cause a post-mortem appearance of extreme cerebral anæmia. In marked cases of this kind the pia-arachnoid may, in its œdematous condition, be

fully one-half inch thick over the superior surface of the brain and much thicker when it dips down into the cerebral fissures and sulci. In other cases no œdema is present, but scattered patches of white fibroid thickening are scattered over the surface of the pia, or along the cranial nerve-roots at the base. The location of these often explain special points in the symptomatology during life. Bevan Lewis states that thickening of the pia mater is present in nearly one-half of the autopsies upon insane persons, and my experience, as pathologist at the Morris Plains Hospital for the Insane, fully corroborates his estimate of the great frequency of this lesion in insanity. It is probable that the chronic inflammatory changes above referred to, when occurring in this class of patients, together with the œdema and cerebral atrophy, are all links in the chain of degenerative changes, which are primarily due to pathological alterations in the walls of the blood-vessels. In the tubercular and syphilitic cases, and in those cases due to chronic alcoholism and traumatism, the same cannot be said, for, although it is true that the lesions themselves are most frequently secondary, they have, in such cases, a much greater causal relation with the symptoms observed during life.

Prognosis.—The prognosis is very grave in all these cases. Early recognition of the condition is important, and may result in the cure of some cases, especially among those of syphilitic origin. Operation in focal lesions due to traumatism may likewise effect a cure, but the outlook in the vast majority of cases is bad, for they rarely come under observation until the lesions in the membranes are advanced, and their secondary injurious effects upon the brain clearly well marked.

Treatment.—The patient in whom

chronic leptomeningitis is suspected should be relieved of all care and worry as far as possible. The hygiene and diet should be strictly regulated. The exercise should be suited to the physical condition of the patient, and the general vitality increased in every possible manner. Tonics, good food, massage, electricity, and the careful regulation of the bodily secretions are the chief means at our disposal. The man who has been overworked should have complete change of air and scene, and for the otherwise-healthy cases a long trip to the woods of northern Maine or Canada during the summer and early fall sometimes proves of great value in so changing the nutrition of the patient, and increasing the vital resistive element of the system to such a degree, that a markedly favorable impression is made upon the chronic meningeal inflammation, which is, as we have seen, too often of the nature of a degeneration, in that it usually occurs coincidentally with other degenerative changes.

The other indications are to relieve headache when present, and diminish, if possible, the local lesions. In syphilitic cases treated early there is hope of real or relative cure, or of great improvement in other cases if the general health will permit of mercury and the iodides. In cases permitting their free use, they should be given in full doses to their decided physiological limit. In weak cases small doses must be given, and even these are sometimes poorly borne.

Traumatic cases demand careful study to decide whether an operation should be done. This should only be performed when from the localizing symptoms there is sufficient hope of relieving irritation or pressure symptoms to warrant the risk of trephining. When clearly focal meningeal symptoms occur after traumatism

and at the point of injury, the trephine should be used, and if thickened and indurated membrane is found the fibroid tissue should be excised. At times the mere removal of a button of bone will relieve the symptoms, probably by relief of intracranial tension.

Counter-irritation is advised, by some writers, by cautery or seton to the back of the neck. Frequent hot baths may be tried in suitable cases. Ergot and bromides are said to be useful, and do aid in relieving pain. For insomnia it is best to avoid opium, and employ sulphonal, trional, or a mixture of chloral and bromide of sodium. While, in general, advanced cases yield small returns to treatment, some cases of chronic leptomeningitis will be found in which persistent careful treatment will amply repay the effort by the most gratifying results.

Spinal Meningitis.

Spinal meningitis means inflammation of the meninges of the spinal cord. The same general anatomical and pathological conditions govern inflammation of the membranes of the spinal cord as have been referred to in connection with cerebral meningitis. Thus, inflammation of the spinal membranes may be divided into (1) *pachymeningitis*, which may be *external* or *internal* in its location; and (2) *leptomeningitis*, which may be *acute* or *chronic*. Just as in the brain, inflammation of any one of the spinal membranes may spread to and include the others, or the substance of the spinal cord itself may be involved, and this meningomyelitis corresponds in its etiology and pathology to meningoencephalitis occurring so often in the brain as a result of primary inflammation of the membranes. Clinically and pathologically it is impossible to always draw distinctions between inflammatory states of the spinal membranes, and this classifica-

tion of the subject upon a purely anatomical basis is somewhat misleading, although for purposes of conciseness and clearness of description it has been followed by writers upon the subject.

External Spinal Pachymeningitis.

Definition.—External spinal pachymeningitis means inflammation of the outer layer of the spinal dura mater. It is a secondary affection.

Symptoms.—These will depend upon the location and extent of the pachymeningitis. There is tenderness over the affected portion of the spine, pain radiating over the spinal nerves involved, hyperæsthesia and spasm of the skin and muscles supplied by them, changing to complete anæsthesia and paralysis should the inflammation be a destructive one, or if the nerves are functionally cut off by pressure of the exudate. In extreme cases the spinal cord is compressed, and we may have spastic paraplegia, and other evidences of pressure. A secondary myelitis is often set up by the same cause producing the pachymeningitis, and the symptoms of the lesions are often associated.

Diagnosis.—This depends upon the recognition of the cause. In obscure cases it may be taken for myelitis, with which it is frequently associated as compressive myelitis. A review of the history of pain, hyperæsthesia extending over some weeks or months, with final development of paralytic symptoms, separates the affection from myelitis, with its girdle sensation, decided onset, and early paralysis.

Etiology.—The chief causes of spinal pachymeningitis is caries of the spinal vertebræ, as in vertebral tuberculosis, Pott's disease, and from tumors or abscesses pressing on the spinal column and causing erosion of the vertebræ. It may also arise from collections of pus in

the pleura, peritoneum, and posterior mediastinum.

Case of spinal caries with pachymeningitis involving the dorsal and cauda-equinal regions. Cheesy nodules were found in both lungs and thickened patches of dura, on which were cheesy nodules that pressed upon the cord. The arms and legs had been paralyzed, contracted, and atrophied. Sinkler (*Jour. of Nerv. and Mental Dis.*, June, '90).

Case of cerebro-spinal meningitis of tubercular origin, beginning in the internal surface of the dura mater of the cord and only involving the bone secondarily. Bewley (*Brit. Med. Jour.*, June 11, '92).

Pathology.—The affected portion of the spinal dura in cases of simple transmitted irritation, may be thickened by organized, newly-formed connective tissue. Very frequently in tubercular cases it is the seat of suppuration or exhibits great thickening with deposits of cheesy pus here and there. When malignant tumor is the cause, it may be indistinguishable from the tumor-tissue.

Prognosis.—The prognosis is bad unless surgical relief can be afforded. Cases caused by Pott's disease offer the most hope of recovery.

Treatment.—This will depend upon the causes mentioned under **ETIOLOGY**, and the reader is referred to the sections devoted to them for a full description of appropriate therapeutic and surgical treatment. The majority of cases arise from spinal caries; so that the treatment of this affection is practically that of Pott's disease. Counter-irritation may be used from time to time, but only after the spine has been immobilized. Tonics, and a life in the air and sunshine daily, are valuable aids in treatment.

Internal Spinal Pachymeningitis.

Definition.—Internal spinal pachymeningitis is a chronic inflammation of the inner surface of the spinal dura mater, marked frequently by coincident

hæmorrhage, and analogous to the cerebral form of the disease.

Symptoms.—The disease begins slowly and no very marked symptoms denote the beginning of the disease. Hyperæsthesia and pain over the spine, or at the periphery of the spinal nerves arising from the diseased area, may be for a long time the only clinical features noted. As the disease progresses there is a gradually-developed paresis, with atrophy of the muscles supplied by these nerves, together with a corresponding distribution of anæsthesia. When the cord is compressed by the exudate, spastic paraplegia is added to the symptoms, or, if the compression is in the cervical region, all the muscles below that point are spastic and paretic. The reflexes are increased in the paralyzed limbs. Most of the cases die from intercurrent disease or gradual exhaustion, frequently added to by the occurrence of bed-sores.

Diagnosis.—The diagnosis from myelitis may be difficult. In the later stages they are very often associated. Symptoms of spinal-cord irritation are more prominent in the meningeal affection, while anæsthesia and paralysis are usually more complete in myelitis. In internal spinal pachymeningitis the onset is slower, and the developments of the more severe symptoms of the affection is much more delayed than in ordinary cases of myelitis. The history of the case is important in diagnosis, and the coincident existence of cerebral symptoms may assist in forming an opinion. The pain of pachymeningitis is made worse by even slight movements, while that of myelitis is not influenced by movements of the body. Rigidity and contractions of muscles are far more common in internal pachymeningitis, while incontinence of the bladder and rectum is a marked feature of myelitis.

Etiology.—This lesion is found in general paresis of the insane, and also occurs as a result of syphilis, traumatism, exposure to cold, chronic alcoholism, and possibly as the result of the rheumatic or gouty diathesis. Like the analogous brain condition, it is a disease of the male sex in the vast majority of cases, and occurs chiefly after the age of thirty years, most cases occurring between the fortieth and sixtieth years.

Pathology.—The inner surface of the dura presents the same lesions which are seen in the brain in similar conditions of system. There is great thickening of the dura, due to successive layers of pseudomenbranous formation, into which small or large hæmorrhages have occurred from time to time during the progress of the disease. The disease may be found throughout the whole length of the spinal cord, or it may be limited to a few inches or even less. The circumscribed form of the affection is apt to be in the cervical region.

In hypertrophic pachymeningitis and chronic infarction of the spinal cord, the pachymeningitic deposit extends along the small vessels into the substance of the cord, the small vessels of the periphery being the carriers of the infarction to the peripheral layers of the cord, which are thereby destroyed; while by means of the arteries of the anterior longitudinal fissure the destructive sclerosis invades the cells of the anterior horns and brings about degeneration of the pyramidal tracts, commissural fibres, and the fibres of the anterior root-zones, extending even into the anterior roots; the latter, however, and the spinal-nerve roots in general, are chiefly, and directly, affected by the external pachymeningitic deposit. The foci of softening are the result of infectious cellular infiltration, as was the pachymeningitic process which preceded it. Tuberculosis and syphilis, chiefly the latter, are probably in most cases the diseases from which the pachymeningitis develops. Adam-

kiewicz (Wiener med. Presse, Apr. 27, '90).

Prognosis.—The prognosis is bad in almost all cases, and chiefly because of the usually broken-down general condition of the patient. A few cases of cure have been reported, and in other cases the symptoms may possibly be arrested by careful and persistent treatment.

Treatment.—The same general measures advised in cases of chronic cerebral leptomeningitis are of use here, and the reader is referred to the paragraph devoted to its treatment. The earlier the condition is suspected, the greater the hope of relief or cure. Locally, counter-irritation may be tried by means of painting the spine with strong tincture of iodine from time to time, or by means of the Paquelin cautery applied over the seat of the suspected lesion. They act favorably upon the pain and tenderness present. Internally, if the patient's condition will bear it, specific treatment should be cautiously employed in syphilitic cases, the doses being gradually increased. In cases presenting signs of a localized lesion, the question of surgical operation may be considered, which is warranted by the otherwise-hopeless condition which results after compression of the cord is established.

Acute Spinal Leptomeningitis.

Definition.—Acute spinal leptomeningitis means an acute inflammation of the pia-arachnoid of the spinal cord; but very often the spinal dura mater and the spinal cord itself are also affected by contiguity. The view is now general that the disease is almost always due to infection, as is the case in cerebral leptomeningitis.

Varieties.—The chief clinical varieties are (1) cases arising from the infection of epidemic cerebro-spinal meningitis, which may expend itself in some cases on

the spinal membranes alone, with very slight or no involvement of the cerebral meninges; (2) sporadic cases of the same disease; (3) cases apparently due to diathetic conditions, including tuberculosis, syphilis, and rheumatism; (4) cases arising in the course of septicæmia, pyæmia, and other acute infectious diseases; (5) cases due to direct extension of the inflammation from the cerebral membranes, usually limited to the cervical cord; (6) cases following traumatism and surgical operations upon the spinal column.

Symptoms.—Acute spinal leptomeningitis has a sudden onset, except in the syphilitic and tuberculous cases, which may arise less abruptly and run a sub-acute course. The prodromes are usually few and may be so slight as to escape notice. Sometimes there is a general sense of being unwell; or malaise, with restlessness, may be complained of; occasionally there is a history of vomiting for some days prior to the onset. When the onset occurs it is ushered in by a severe chill, sharp agonizing pain in the back, shooting pains in the limbs or about the body, with fever, vomiting, tenderness along the spine, easily elicited by percussion, or made evident by holding a hot, moist sponge over the spine. These symptoms are followed within a few hours by spasmodic rigidity of the spinal muscles, retraction of the head if the cervical cord is involved, and flexion of the limbs upon the trunk, with very marked rigidity of the limbs. The abdominal muscles are contracted, giving an apparent retraction of the abdomen, and the chest-muscles may be so fixed by spasm as to cause embarrassment of the respiration. If the medulla oblongata is affected, rapid, irregular, or Cheyne-Stokes respiration may be observed, with rapid and irregular cardiac action due to

the same cause. There is marked general muscular hyperæsthesia, and any attempted movement of the limbs adds greatly to the sufferings of the patient. The pulse may be very rapid, and is often most irregular. The temperature varies from subnormal to 104° F., and a lower range is the rule. The reflexes are diminished except at the beginning, when they may appear to be exaggerated. The skin may be flushed, pale, or livid in appearance. A deep-red, persistent marking follows the pressure or stroke of the finger-nail over the skin. The form of paralysis which may develop after the symptoms above noted will depend upon the location of the inflammation and the affected roots of the spinal nerves. Usually the inflammation is wide-spread and nearly all parts of the spinal membranes are involved in the process. The most common type of paralysis is spastic paraplegia, with paresis of rectum and bladder. This form in cases surviving this period presents almost identically all the symptoms of cross-myelitis, and as the case progresses bed-sores are a distressing feature of the case. The duration of the disease is from a few days to a few weeks, when, if the patient survive, a slow, tedious recovery may occur. Recovery is nearly always coupled with some degree of paresis or paralysis, which is very persistent, and too often permanent.

Diagnosis. — The diagnosis of acute spinal leptomeningitis is sometimes very difficult. The symptoms of spinal irritation observed in the acute infectious diseases at times simulate very closely this affection, but post-mortem examination does not often reveal its lesions. The course of the disease in these pseudo-cases will generally differentiate them, for it is at the beginning of such spinal symptoms that the mistake is liable to be made. The diagnosis of the different

forms met with is often exceedingly difficult. The presence of tuberculosis in the lungs or elsewhere is an aid to diagnosis, and the same may be said of the known presence of syphilitic infection or positive active lesions of this disease. Cases arising during epidemics or endemics are easily recognized. So are the cases arising from traumatism, operations on the spine, and those due to extension from the cerebral membranes. From the nature of the post-mortem appearances it is seen how frequently the spinal cord may suffer in this disease, so that in the later stages myelitis is frequently co-existent with it. In the first of the illness it is distinguished from myelitis by the paralysis and absence of marked pain in myelitis, and also by the very variable character of the pulse and temperature-curve in acute leptomeningitis.

Bacteriological investigation is an important means in the diagnosis of spinal meningitis. This bacteriological observation may be performed by taking a small quantity of blood from a vein, putting it into a thermostat warmed to 98.6° F., and leaving it there for ten or twelve hours. If the diplococcus is present in the blood, numerous colonies of these micro-organisms will be seen upon the surface of the coagulum. Bozzolo (*Internat. klin. Rund.*, Mar. 31, '89).

Only 4 cases of central softening of the spinal cord in syphilitic meningitis have been described. It is liable to be mistaken for syringomyelia. Case of female who had had syphilis. The illness began with pain in the back, followed by headache, then weakness and rigidity of legs. The patellar reflex disappeared. Later, painful spasmodic contractions often occurred in right leg, and later still girdle pains became troublesome. The legs finally became atrophied and completely paralyzed, and bed-sores and paralysis of sphincters developed. Post-mortem examination disclosed a central cavity, localized to the gray matter, extending from the lower lumbar to the upper cer-

vical regions, also syphilitic meningitis and syphilitic disease of the vessels. H. Wullenweber (Münch. med. Woch., Aug. 9, '98).

From subdural and interspinal hæmorrhage it is differentiated by the great suddenness of the former affections, which instantly produce their symptoms, and always follow some obvious traumatic cause. Subdural hæmorrhage is usually followed by some grade of leptomeningitis soon after its occurrence.

Etiology.—The great majority of cases arise from infection of the pia-arachnoid, although the source of the infection is often difficult or impossible to trace. The spinal type of leptomeningitis occurs quite frequently during epidemics of the cerebro-spinal form. In general practice the tubercular form is the one most commonly met with. Spinal leptomeningitis is a rare complication of the acute general diseases, such as pneumonia, typhoid fever, scarlet fever, yellow fever, and small-pox. According to Osler, it is very rare in pneumonia, even when cerebral leptomeningitis occurs, excepting for "the first two or three inches of the cervical region" (Osler's "Practice of Medicine"). It is more common in septicæmia and pyæmia. Exposure to cold and dampness is regarded as a cause of spinal leptomeningitis by some writers.

Pathology.—The post-mortem appearances vary with the duration of the case and the nature of the inflammation. The tendency in all cases is to spread, and involve the whole length of the spinal canal, but, in a considerable proportion of cases the inflammatory condition is limited to the cervical region. The spinal membranes and fluid furnish excellent conditions for the growth of pathogenic bacilli, and for this reason wide-spread lesions are usually present.

Cases dying within a few days present intense congestion of the pia-arachnoid, and very frequently of the inner surface of the dura mater, and of the spinal cord itself, with an effusion of more or less turbid serum; or the exudate may consist of sero-plastic lymph. In other cases the exudate is purulent and very abundant. When the disease has a duration of a week or two the autopsy reveals grayish-white opaque pia mater. In cases of longer duration there may be adhesions formed between the arachnoid and the dura, and the pia may be abnormally adherent in places to the spinal cord. Tubercular inflammation here does not differ from that already described in treating of tubercular inflammation of the cerebral membranes, and the syphilitic form of the disease likewise presents the same kind of inflammatory changes which have been described as syphilitic leptomeningitis. All of these acute inflammations finally attack the nerve-roots and the general surface of the spinal cord, and, even in cases which do not show any macroscopic lesions, by the microscope very marked lesions of acute inflammation of the nervous elements are found. The axis-cylinders of the nerves are swelled and degenerated, and in the cord there is proliferation of neuroglial cells, infiltration of leucocytes, granular degeneration of nerve-fibres, and dilatation of the blood-vessels and their sheaths with leucocytes. Various forms of bacteria have been noted, including the pneumococcus of Friedländer and the tubercle bacillus. This condition of meningomyelitis exists in some degree in many of the cases, and at times may be so marked that there is seen macroscopically superficial softening of the spinal cord and the nerve-roots; while, in cases dying after the disease has become chronic, there may be,

in addition, extreme changes of the spinal cord and the nerve-roots, from adhesions formed in places between the adherent arachnoid and the dura. In such cases, besides the superficial softening of the cord, there is found parenchymatous alterations of the gray substance or foci of suppuration in other parts of the cord.

In epidemic cerebro-spinal meningitis two kinds of alternation in the cells of the spinal cord noted. First, slight changes in the cells of the anterior horns, such as occur from various poisons and which is attributed to the toxæmia of the disease, viz.: (1) the disappearance of the stainable substance of Nissl from dendrites or from portions of the dendrite or of a cell-body; (2) the formation of nodular swellings of the dendrites, these swellings corresponding to pathological accumulations of the stainable substance; and (3) a tendency to disorganization of individual Nissl bodies, especially at the periphery of the cell. Second, lesions not all similar to the first, but practically identical with those which take place in the cell-body of a neuron after an injury of the axon which belonged to it. These latter changes were found in the cells of the anterior horns and in those of Clarke's columns. L. F. Barker (Brit. Med. Jour., Dec. 25, '97).

Prognosis. — The prognosis is always grave. It is especially serious at the extremes of life, which bear the disease very badly, and death within a few days is the most frequent termination in such cases. The rapidly-fatal cases are characterized by very abrupt onset, high fever, and extensive involvement of the spine, including the cervical regions. Cases in which the cervical region is affected are always most serious. The outlook in traumatic and syphilitic cases is more favorable, and recovery may in some of these cases be fairly perfect. In the other cases, even when recovery occurs, secondary spinal lesions may result

from inflammation and degeneration of areas of the cord itself.

Treatment.—As soon as possible after the onset of the disease the patient should be put to bed, resting on the side, or, as advised by some writers, upon the abdomen, over several pillows placed under the patient. This has the advantage of permitting applications to the spine, but is not always borne by patients. Morphine sufficient to control the agonizing pains should be administered at once hypodermically. Prompt applications along the spinal column should be made, and the means employed may include wet cupping, leeches, thermocautery, repeated dry cupping, and blisters. Leeches should not be used in the cases of young children or in weak persons of any age, but should be reserved for sthenic subjects. Dry cups are a valuable measure when applied vigorously and repeatedly. Care should be exercised not to break the skin, for if myelitis should supervene it would predispose to the formation of bed-sores. If well borne, continuous application of the spinal ice-bag is a valuable measure. At the same time, internally small doses of calomel frequently repeated should be given, with bromides and chloral to diminish spinal irritability. A very valuable remedy, which is often very efficacious in allaying pain, and probably also acts as a powerful detergent, is the hot bath or hot pack.

If there is evidence that the attack is due to syphilis or rheumatism as underlying causes, specific or antirheumatic remedies should be given in full doses at once. Opium, according to Stillé ("Epidemic Cerebro-spinal Meningitis," p. 158, '67), is most efficacious in epidemic cerebro-spinal meningitis, and by analogy it should be used with hope of good results in limiting the inflammation as

much as possible. It is needed usually for the excessive pain and restlessness, and may be combined with the bromides and with chloral. Ergot and tincture of belladonna are both used at times during the acute stage to contract the blood-vessels, but the former is more useful, in combination with the iodide of potassium, after the acute stage to assist in promoting absorption, while the value of belladonna in such cases is problematical. In fact, the use of ergot to contract the blood-vessels of an inflamed area is largely a matter of clinical habit, and no definite proof exists that it really has this action upon the inflamed tissues.

Should the patient survive the acute stage, milder measures of counter-irritation are useful in keeping up a detergent effect upon the congested spinal cord. Hot baths may be continued, and the alternate hot and cold spinal douche is of value in relieving the congestion.

Massage and electricity may also be used. Internally potassium iodide is the best absorbent. It should be combined with mercurial treatment in syphilitic cases. Mercurial inunctions may be employed along the spine. They also do good by the counter-irritation caused by them. When cerebral symptoms arise, the treatment is that of cerebro-spinal leptomeningitis, which has already been described.

Chronic Spinal Leptomeningitis.

Definition.—Chronic spinal leptomeningitis means chronic inflammation of the spinal pia-arachnoid. It is frequently associated with chronic inflammatory changes of the adjacent dura and spinal cord, and is usually a sequence of some form of acute spinal leptomeningitis.

Symptoms.—The symptoms in lesser degrees are those of the acute form. Pain in the back, with shooting neuralgic

pain in the body and limbs, and frequent paræsthesia of the skin over corresponding areas are the chief symptoms. Paralysis is infrequent except in cases where it may be residual from the primary acute attack. Rigidity and spasm are not marked symptoms of the chronic disease and are more commonly absent. In some cases few symptoms are present during life. In all cases the symptoms are very indefinite. Some form of skin eruption has been noted, with hyperæsthesia, pain, and some rigidity of the spinal muscles. It runs a very chronic course, and usually exists for many years prior to death.

Diagnosis.—The diagnosis is most often obscure, and the condition can only be conjectured from the group of symptoms enumerated, when associated with a clinical history predisposing to the condition.

Etiology.—The chief etiological features are previous attacks of leptomeningitis, chronic alcoholism, syphilis, traumatism, or strain of the spinal column, and as a complication of various forms of myelitis.

Pathology.—The post-mortem appearances which have been noted are thickening of the pia-arachnoid, adhesions of its dura, local thickening of the membranes enveloping the nerve-roots, and adhesions between the pia and the spinal cord, which may be sclerosed at points where adhesive bands are attached to it.

Prognosis.—Recovery from this form is doubtful and probably never occurs, the disease slowly progressing until death.

Treatment.—The treatment is symptomatic. Mild, intermittent counter-irritation may be used with benefit in relieving the pain. Internally the iodide of potassium may be given in doses commensurate with the general condition of

the patient and with the existence or not of a syphilitic history. Tonics and all measures tending to improve the systemic condition of the patient are usually necessary to these cases.

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MENOPAUSE, DISORDERS OF.

General Considerations.—All the organic diseases of various kinds begin to show their full effects at about 45 to 50 years. If a woman's organs are not all sound, she is apt to break down at this age; on the other hand, if there are no organic disorders, abnormal conditions do not develop, and the woman who was healthy before remains healthy throughout the climacteric period.

The association of morbid conditions with the menopause is accidental and the result, usually, of antecedent causes, especially of unphysiological living. The influence of perfect nutrition and natural living during the premenstrual and adolescent years upon the after-life of women is of the most salutary and far-reaching kind. A. H. Bigg (Amer. Medico-Surg. Bull., Jan., '93).

The various malignant diseases, which are prone to show themselves at about the time of the change of life, are often attributed to menopause as an entity; but, in truth, the vitality with which we are endowed is always diminishing, the reserve force is lessening, and at an age varying from 45 to 55 years there is very little margin to draw upon. This is not confined to women, however, for it is seen in the fact that men are not accepted for enlistment above the age of forty-five, while at sixty they may also be said to undergo a "change of life."

The menopause, properly speaking, is only one feature of the change of life. The woman is no longer strong enough to bear and rear children, except in com-

paratively few cases. She has not the vitality to endure the continually recurring drain of menstruation, and this function ceases at about the end of the ninth lustrum, varying much according to race and climate.

Series of 250 cases studied as regards the age at which menopause takes place. It occurred in 2 women aged 37, in 2 aged 38, 3 at 39, 12 at 40, 3 at 41, 11 at 42, 6 at 43, and 8 at 44. Beyond the normal ages the change came on in 3 patients at 54, and in the same number at 55, and in 1 at 56, and the same number in patients of the age of 57, 58, and 59, respectively. Parviainen ("Mith. aus der gynäk. Klinik der Prof. Engstein," vol. i, Part II, '97).

Menopause in five cases in women whose ages ranged from twenty-two to thirty-five years. Three were in good health; in one menstruation ceased after typhoid fever, though no direct causal relation could be established. One patient subsequently developed diabetes, from which she died. In all, menstruation had previously been somewhat scanty, and three had been sterile. Climacteric disturbances were slight. The usual anatomical changes, especially atrophy of the cervix, were well marked. Treatment in true cases of premature menopause is useless. Siredey Comptes-rend. de la Soc. d'Obstet. de Gyn. et de Pæd., Dec., 1903).

The disorders of the menopause, *per se*, are really only those which are in some way connected with the cessation of menstruation, and they are comparatively few and simple; while the disorders and symptoms occurring at the period of the change of life or grand climacteric in either sex, but especially in woman, are many and various, and often very severe.

Of late years the frequency of operations for the removal of the ovaries has caused the subject of the sudden and artificial menopause thus brought about to assume great importance, and, as its symptoms and its disorders can be

studied apart from the symptoms of advancing age and progressive disease, much valuable light has been thrown on the question of the menopause proper by studying the history of the symptoms following the post-operative menopause.

Among the afflictions which are customarily attributed to menopause are the most-varied nervous manifestations, and disturbances of temperament, and even of mental condition. But here, also, it is necessary to discriminate between what is due to the cessation of menstruation, and all the woes that begin to darken the life of so many middle-aged women. For, at this period, some women are profoundly unhappy, and not without reason. Beauty fades, they grow obese and gray, and feel their age in all their social relations. Above all there is the feeling that there is no proper sphere of activity left for them. They have no business, as men have, to occupy their attention. A woman very probably has no interests which really engross her and give her an aim in life. It is, indeed, a change of life; but it really has nothing to do with the menopause. The nervous system feels the influence of these altered conditions, and despondency continues until she gets used to her new relations with her surroundings and acquires new interests.

General Symptoms.—The disorders of menopause are divisible into two general classes, which are subdivisible into several subclasses:—

- | | | |
|----------------------|---|-------------------------|
| I. Disorders of the | { | Flashes. |
| circulation | | Hæmorrhages. |
| II. Disorders of the | { | Palpitations. |
| nervous system | | Hystero-neuroses. |
| | | Psychical Disturbances. |

Besides these, it is necessary to recognize, practically, a third division:—

III. Complications, or disorders incident to the period of life during which the menopause occurs.

DISORDERS OF THE CIRCULATION.—

Flushes.—When flashes, or flushes, occur the blood rushes suddenly to the surface of the body, particularly to the face and neck, causing a violent burning and tingling sensation and a high color, followed in a few minutes by a free and distressing perspiration. These phenomena are best observed in vigorous young women from whom the ovaries have been removed, for in them the flashes often come on within two or three weeks of the operation, and continue for several months, or even for over a year. They may recur as often as once in fifteen minutes, but generally the intervals are somewhat longer. After six or eight weeks the flashes become less frequent, without diminishing much in violence, and finally they diminish both in frequency and intensity, until they cease to recur.

[The following description of her sensations is written by a very intelligent young lady, from whom the tubes and ovaries were removed eighteen months previously, for a small fibroid of the uterus, with retroversion and incarceration. The tumor in the uterus has diminished in size during the interval of time, and the uterus is held in proper position by ventrofixation.

"I am afflicted regularly with 'flushes' at intervals of from 40 to 50 minutes, day and night. They are sometimes preceded by slight faintness or chill; then, again, with dizzy feeling, or slight headache. I can almost feel myself turning pale, when it seems that the blood is leaving every part of body; so noticeable is it that just previous to a 'flash' I have been asked 'Are you cold?' 'Are you faint?' or 'Are you ill?'"

"In a few seconds, however, a sort of resigned feeling unconsciously takes possession of me, when suddenly a wave of heat rushes over face, arms, and upper part of body, face and hands turn a most

uncomfortable red color; soon the heart beats very hard, and I can almost hear it thumping. Soon beads of moisture begin to stand out on my forehead, chin, neck, at joining of lower and upper arms, and on bosom, after which the heat permeates the lower part of body, to my toes.

"When a 'flash' is preceded by drowsiness, for some few seconds I can scarcely keep my eyes open—seem to be as in a dream, and arms and legs feel heavy. When preceded by a chill, hands and feet feel cold. Always before 'flash' my throat feels parched, and I am very thirsty. 'Flashes' seem to be more severe after a hearty meal." E. W. CUSHING.]

In the physiological menopause the same flashes are observed, although, usually, they are much less violent; they are also apt to last rather longer, sometimes for two years or more. Although these are usually classified as disturbances of the circulation, they are properly nervous phenomena. The vascular system merely responds to the stimulus which causes blushing under emotion, and is not in itself disordered at all. The whole subject, therefore, might be included properly under the disorders of the nervous system.

Hæmorrhages.—Perhaps the same might be said about the sudden attacks of hæmorrhage which sometimes occur at about the time of the menopause, just as they do at puberty, and, indeed, occasionally at all periods of the sexual life of woman.

So many cases have been reported that it must be admitted that such hæmorrhages really occur at the menopause, merely as a result of vasomotor disturbances, and without any appreciable disease of the uterus.

Nevertheless, a vigilant and painstaking skepticism should be the rule, for usually some complication will be found which will account for the hæmorrhages, especially if they are repeated and recur

at intervals covering a considerable space of time. The apathy and credulity with which the women attribute these hæmorrhages to the change of life are only the result of the false teaching of the profession at times when the pathology of uterine diseases was not understood. Many a valuable life is lost because flow at this time is attributed to the climacteric, when really there is grave organic disease present and progressing.

Personal observations based on 373 cases. Assuming that the normal menopause occurs between the ages of forty-five and fifty years, it was found that in 130 women the climacteric atrophy of the internal genitals was present too early. In 40 menstruation did not cease until after fifty years; 13 were fertile at forty-five years and over. Senile endometritis was noted in 7 cases. In 4 women between the ages of fifty-eight and seventy-one years, who had always enjoyed good health since the menopause, metrorrhagia appeared, due, apparently, to calcification of the uterine vessels, since no other cause could be assigned. Kleinwachter (Centralb. f. Gynäk., No. 20, 1902).

DISORDERS OF THE NERVOUS SYSTEM.
— "*Palpitations.*" — The symptoms of "palpitation of the heart" and of attacks of syncope from which women suffer at the time of the climacteric are quite similar both in kind and degree to those with which a certain proportion of women of all ages are troubled. The only feature peculiar to the change of life is that women often present these symptoms at that period who have not been troubled in this way during their previous years, and who certainly have no organic lesion of the heart. Like the flushing and the uterine hæmorrhages mentioned above, these symptoms are to be understood as disturbances of regulation, not as diseases.

Hystero-disturbances and Psychological Disturbances.—These phenomena do not

differ at all from those which affect nervous and hysterical women at other periods of their lives, the only peculiarity is that they sometimes attack women who have always been free from such troubles.

It will not, therefore, be necessary to describe the various symptoms and varieties of hysterical and hysterico-neurotic disturbances, the alterations in temper and temperament, ranging all the way from caprice to melancholy, which may affect women at this change of their lives. What is desirable to know is why these disturbances should affect some women at this time and not others, and whether anything can be done to relieve them.

It is quite evident that at the menopause we have to do with two processes: (1) the cessation of function of the ovaries and of the menstruation, which is the accompaniment of such function; (2) the involution of the uterus, which goes on, or should go on, *pari passu* with the diminution of ovarian activity. The histories of women who suffer from hysterical and nervous disorders at the menopause, and those of women who suffer from hyperinvolution or from originally insufficient development of the uterus are very similar, and careful study of individual cases has led me to believe that the disturbances of the former are largely due to want of proper relation in time or in amount between the diminution of functional activity and the involution of the ovaries and of the uterus, respectively.

When the function of the ovaries ceases too suddenly for the uterus, or when — owing to congestion, endometritis, polypi, small fibroids, or other causes — the uterus cannot undergo involution concurrently with the ovary, flashes and hæmorrhages follow, com-

plicated with the general train of symptoms witnessed after surgical removal of the ovaries.

Hæmorrhage is not a necessary concomitant of the menopause. When it does occur, other than a metrorrhagia in the true sense of that term, it is in 95 per cent. of the cases significant of a pathological condition. During the past three years 482 healthy women over 52 years of age have been interrogated. Of these only 39 gave a history of what could be termed a hæmorrhage during the menopause, and out of this number only 5 gave a history of hæmorrhage of any persistency. In 287 tabulated patients, between 43 and 50 years of age, suffering from uterine hæmorrhage, 19 were due to pregnancy, 48 to malignant disease, 53 to fibroids or uterine cysts, 10 to diseased endometrium, 26 to diseased appendages, while in 31 no positive diagnosis was made. All persistent hæmorrhages during menopause should be regarded with suspicion. John M. Duff (Jour. Amer. Med. Assoc., Oct. 21, '99).

When, on the other hand, the uterus tends to cease its functions sooner than the ovary, stimulation originating from the latter to continue menstruation gives rise to a set of symptoms similar to those witnessed in cases of hyperinvolution of the uterus after childbed or prolonged lactation or exhausting diseases; or in cases of undeveloped uterus, where after puberty the infantile condition of that organ remains, while the ovaries develop fully.

Atresia of the uterus after the menopause occurs pathologically much more frequently than is supposed. The atresia is physiological only after complete atrophy of the body of the uterus and its endometrium. The symptoms of the condition mislead by directing attention to the nervous system more particularly than to the true seat of disease. H. L. E. Johnson (Jour. Amer. Med. Assoc., Dec. 7, '95).

At the period of the menopause the vulva is apt to become affected with local hyperæsthesia, which is a symptom

of many conditions. It may be due to a pure neurosis; to reflex cause, such as early carcinoma cervicis; to mucous polypus or prolapsed ovary; or to kraurosis, local rashes, dirt, parasites, vaginal or uterine discharges; irritating urine, as in cases of acidity, gout, or diabetes. Amand Routh (West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

Neuroses seen at the time of the menopause show many gradations from nervous irritability with effects on the character and temper to fully-developed insanity, which has a tendency in a large proportion of cases to melancholia, a delusional insanity, less frequently to mental weakness, and rarely to general paralysis. The change in the reproductive organs leads in some to a morbid querulousness, in others to a jealousy. Sexual excitement sometimes is developed which exceeds all control, depraved and vicious habits may show themselves, and dangerous accusations be made. Drunkenness and the drug-habit are especially noted at the climacteric. Charles Luke (West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

Attention called to dyspareunia at this period. Cases occur where the introitus is small; the mucous membrane of the vulva has already acquired that smooth and glazed appearance characteristic of senility, and around the ostium vaginæ are certain red, well-defined circumscribed spots, extending forward and involving the meatus urinarius and the urethral canal. These are exquisitely tender and bathed in a muco-purulent discharge. Mansell-Moullin (West London Medico-Chir. Soc.; Univ. Med. Jour., Mar., '97).

While the cilia of the uterine and cervical epithelium grow scanty in sickly women near the menopause, they sometimes remain perfect in women over 60 where the uterine muscular tissue has undergone degenerative changes perceptible to the naked eye. Parviainen ("Mith. aus der gynäk. Klinik der Prof. Engstein," vol. i, Part II, '97).

Headache, nervousness, hysterical manifestations of all kinds, depression of spirits, change of temperament always for the worse, even real melancholy and insanity; such are the woes which are

added to the unpleasant conditions inseparable from this age, and referred to in the beginning of this article.

Attention called to the very intimate relation which exists between the menopause and the pathological conditions of the uterus and exophthalmic goitre. In this relationship the latter is placed in the position of an effect or consequence, and not the cause, of the uterine condition. An improvement in the local condition is always followed by the appearance of the general disease. Jouin (Nouv. Arch. d'Obstét. et de Gynéc., No. 6, '95).

Investigation of one hundred cases of insanity occurring during menopause. The forms were present as follows: Melancholia in 67 per cent.; mania, 24 per cent.; dementia, 4 per cent.; epileptic insanity, 3 per cent.; general paralysis, 2 per cent. The prognosis is usually favorable, 40 per cent. recovering. The duration of the attack varies from three months to three years, after which time the outlook is hopeless. Henry Sutherland (Univ. Med. Jour., Mar., '97).

During the past few years a number of women have been received in the Pennsylvania Hospital for the Insane who had been operated upon for the removal of the sexual organs, the majority of whom subsequently had melancholia with many of the usual symptoms attending the menopause, which had been anticipated by surgical interference, showing that, whether the grand climacteric is brought on in the course of nature or by the methods of science, the mental results are quite similar when any have appeared.

It has been observed that many women who have been melancholy, or threatened with insanity at the menopause, have at the age of puberty also had serious neurotic or mental symptoms. This circumstance has been cited on which to predicate a probable recurrence at the menopause. The statistics of the Pennsylvania Hospital show that between the ages of 15 and 20, embracing the beginning of the menstrual life in women and the age of puberty in men, 284 men, and 276 women were admitted. Between the ages of 45 and 55, covering the usual period of the menopause, 975 men and

876 women were admitted into the same hospital. From these data it would appear, as far as they indicate anything, that at both of the periods named more men than women become insane. If the menopause alone was a serious and important factor in the production of insanity, it would so appear in the tables. Admitting that melancholia is the most frequent form of mental disease that occurs at the menopause, it would be a logical conclusion that a much larger proportion of cases of this form would occur at this period. The exact percentage of cases between the ages of 45 and 50 was for men, $20\frac{1}{6}$; women, $21\frac{2}{6}$; or practically there was no difference in the sexes. Therefore, outside of the narrow limitations named there is no sufficient clinical experience to warrant the recognition of a distinct class of insanities as due to a normal ending of an animal function that is universal. J. B. Chapin (Phila. Med. Jour., Aug. 25, 1900).

Complications.—The complications or diseases incident to the time of life at which the menopause occurs are, in reality, the factors that have caused the change of life to be dreaded and to be looked upon as a serious crisis.

In all cases in which a patient comes under the care of the physician at this age, perhaps more than at others, it is important to ascertain that the heart and kidneys are free from organic disease. This is the period when these organs are apt to fail, in either sex.

Attention called to the frequency of utero-ovarian irritation at the time of the menopause as a factor in the causation of rheumatoid arthritis. W. Armstrong (Brit. Gyn. Jour., xliv, 496, '96).

Following the cessation of the menopause the modification of the menstrual flow can cause a congestion of the kidneys, varying in its intensity. The symptoms observed have been oliguria, albuminuria, and hæmaturia, often accompanied with lumbar pains, nausea, and headache. Local bleeding and mild diuretics recommended. Le Gendre (Medico-Surg. Bull., July 25, '98).

Of the diseases more closely connected with the genital system, first in importance, first in gravity, and most serious if neglected, is cancer of the uterus or of the vagina. In all cases of undue or irregular bleeding from the genital tract it is imperative to make a thorough local examination, since in a large proportion of cases the cause will be found to be a cancer. In this matter the knowledge and care of this generation of physicians must undo the mischief that has been wrought by the false teaching of previous generations, that irregular hæmorrhages were natural to the change of life. The truth is that the menopause is an evil period, when cancers are liable to develop.

"Ulceration of the uterus" was also—and is still—too often diagnosticated in cases of uterine cancer attended by intractable bleeding and only recognized when the disease is far advanced and the patients have lost their only chance of rescue.

Certain axioms should guide the modern practitioner in this connection:—

1. All irregular or profuse hæmorrhages about the period of the change of life are suspicious; they therefore require immediate, thorough, and competent examination.

Analysis of the complications of menopause in 500 women. Out of this number, the flow of blood returned a year or more, after the menopause had become established, in 183 cases. Of these over one-half, or 54 per cent., were found to be suffering from uterine cancer. Neumann (Monats. f. Geburts. und Gynäk., B. 1, H. 2, '95).

Diagnosis between benign and malignant bleeding after menopause. Menorrhagia of the menopause appears as a sudden and very free discharge of blood following distinct cessation of the catamenia for two or three months. The discharge occasionally recurs. The bleeding of cancer is insidious, irregular in char-

acter, and very frequently appears in the interval of the period during the last year or two of menstruation. Doléris (Bull. et Mém. de la Soc. Obstet., etc., Paris, No. 7, '97).

2. All cases of incipient cancer of the uterus are easily diagnosticated by careful examination, aided by the curette and microscope in doubtful cases, but usually by the presence and character of an ulcer.

3. All cases of cancer of the uterus in the early stages are susceptible of complete removal by total hysterectomy, with less than 2 per cent. of mortality in competent hands. There is, in fact, no organ of the body where cancer can be so totally and widely removed as in cancer of the uterus.

4. A large proportion, probably a large majority, of cases in which total extirpation of the uterus, for cancer, is performed quite early, never have relapse or recurrence in the scar or elsewhere, and they enjoy, not only life, but the best of health.

Next in frequency, after cancer, when hæmorrhage occurs after menopause are intra-uterine or intramural fibroids. There may also be polypoid growths in the uterine cavity of the ordinary mucous and glandular type. All these may give rise to frequent hæmorrhages that tend greatly to reduce the strength of the patient.

[I have repeatedly removed such growths from women between 45 and 55 years, who had suffered from profuse flowing for long periods under the impression that it was a natural accompaniment of the change of life, and that nothing could or should be done to relieve it. E. W. CUSHING.]

The menopause has very little, if any, influence in arresting the growth of uterine fibromata in a large number of cases; indeed, many examples of their rapid increased growth have occurred. One of the strongest indications for hysterectomy

after the menopause is the tendency of the tumor to undergo some form of degeneration which, of itself, may prove fatal. Hysterectomy after the menopause should be resorted to whenever the usually-accepted symptoms present themselves which are acknowledged to be of sufficient gravity to require that operation in any other period of life. J. T. Johnson (Med. Review, May, '98).

Of special importance is the condition of adenoma of the uterus, which attacks women of this age, often after they have ceased to menstruate entirely. Coming on with the symptoms of a simple hypertrophic endometritis, it is, perhaps, treated by curetting, and apparently cured for some months, when the hæmorrhages commence again, and unless hysterectomy is performed the disease gradually, but inevitably, passes into cancer of the body of the uterus. The diagnosis is easily made on the first curettement, by the abundance and the microscopical character of the pieces of tissue which are removed. As soon as the diagnosis is certified hysterectomy should be performed.

Simple endometritis, with more or less thickening of the mucous membrane, is very frequent at the time of the menopause; it tends to delay the cessation of the menses, especially if there is any polypoid formation, as above mentioned.

In some cases the menstruation either ceases or is very scanty, and the menopause thus occurring is accompanied with nervous symptoms, hot flashes, or even severe hysteroneuroses. A local examination is also important, since some uterine trouble will generally be found to account for the symptoms. In some cases the uterus is retroverted, heavy, and sensitive; in others it is apparently normal in size and position, but it is tender on pressure, and if a sound is passed into it the endometrium of the

fundus is found to be extremely sensitive and perhaps thickened.

Treatment.—In regard to the nervous symptoms, great caution should be used not to commence a course of treatment with narcotics, which is apt to have disastrous consequences. Morphine, cocaine, and other habits are easily contracted by these cases. If all local disorders are properly diagnosed and treated, and nervous symptoms still exist, attention should be paid to the general condition. A kindly word and a little consolation will often go farther than medicine in alleviating the nervous manifestations. When the circumstances of the patient permit it, change of scene, particularly foreign travel, is of the greatest advantage. Anything that will give the woman an interest in life and take her thoughts off herself is distinctly beneficial.

Simple endometritis with more or less thickening is easily cured by curettement and application of strong solution of iodine and carbolic acid, or of peroxide of hydrogen, to the uterine cavity. At the same time any raw surfaces at the angles of the *os uteri*, the result of old laceration, should be carefully repaired, for it is precisely in these neglected lacerations that cancer is so prone to develop.

Curettage of the cavity of the uterus in fibroids where the chief symptoms are menorrhagia and metrorrhagia is useful in three classes of cases, viz.:—

1. In cases suitable for operation; but when the patients are debilitated by loss of blood the procedure affords a period of rest and freedom from hæmorrhage, which allows of recuperation before the major operation.

2. In cases of small fibroids which do not cause pain.

3. In cases in which the menopause is approaching.

In the latter class the operation may

have to be repeated several times. Orloff (*Med. Chronicle*, Aug., '94).

In cases in which there is retroversion or the endometrium of the fundus is found thickened and extremely sensitive, appropriate treatment, by replacement and support, if necessary, and by dilatation of the cervix, and applications of carbolic acid or peroxide of hydrogen to the endometrium, will usually have the happiest results.

The hæmorrhages are sometimes sufficiently severe to demand active treatment, even when no local lesions are to be discerned.

In the hæmorrhages of the menopause hydrastinine is preferable to hydrastis. Porak (*Bull. de la Soc. de Méd. Prat.* Mar. 15, '92).

Hæmorrhage is of the first importance in the climacteric. Purgatives should be employed, particularly against the hyperæmic disturbances and collateral congestion which give rise to the complex symptoms of abdominal plethora. No drastic purgative, however, should be used, but only such as exercise a gradual and continued influence upon intestinal activity, such as pulp of prunes, tamarinds, manna, rhubarb, and the moderate salts. Enemas and intestinal irrigation are also of value, with dietetic and hygienic measures, Glauber salts, and potash-salt waters. In severe hæmorrhage rest and cold-water injections are indicated, with the addition of aqua ferri, *sus aqua chloridi* (15 to 250). If the flooding does not cease, the vagina should be tamponed with iodoform gauze, and ergot given internally, 20 drops every hour or two. Kisch (*Med. Neuigkeiten f. prak. Aerzte*, Apr. 8, '93).

In climacteric hæmorrhages rest, strict regulation of diet, with the avoidance of alcohol, strong tea and coffee, and the use of laxatives are sufficient in mild cases. Dilatation of the cervical canal and intra-uterine applications of Monsell's solution are preferable to curettement. In obstinate cases in which the patient is really in danger from repeated hæmorrhages total extirpation is indi-

cated, the results being quite satisfactory, while the mortality is only a little over 1 per cent. Reinicke (*Archiv für Gynäk.*, B. 52, H. 2, '97).

The treatment of the various symptoms occurring in the course of the menopause does not differ from that of the same phenomena as witnessed in various diseases. Hence symptomatic treatment meets all indications.

In the treatment of pruritus of the vulva or vagina, so often a complication of the menopause, the patient should be given a lukewarm bath (88° F.) before going to sleep, with the addition of 2 pounds of wheat-bran, placed in a linen sack in the bath. After the bath the vulva and surrounding parts are dusted with the following powder: Salicylic acid, 1 part; starch and talcum, of each, 50 parts; mixed and used as a dusting-powder, several times daily. Of special significance in the climacteric is the diet. Kisch (*Med. Neuigkeiten f. prak. Aerzte*, Apr. 8, '93).

If medicines must be used for the disturbances occurring at the time of the menopause, there is nothing better than the bromide of potassium in sufficient amount to be effective. Ten grains every two or three hours may be given at first, to be continued after it is effective, as occasion demands. A. H. P. Leuf (*Med. Council*, Apr., '99).

Ovarian therapy in the treatment of the phenomena of the menopause has been reported with more or less success. It consists in the administration of the ovary in its natural condition, ovarian powder obtained by desiccation, or a glycerin-extract. The remedy may be given in 2-grain doses before meals. It is usually best to begin with one dose before the noon meals. The remedy is credited by various clinicians with the power of arresting the untoward effects during the climacteric or preventing them when the menopause first manifests itself.

Ovarian tablets possess the power of modifying the unpleasant phenomena of the climacteric, whether physiological or anticipated, without producing evil effects. Landau (*Berliner klin. Woch.*, No. 25, '96).

Ovarian extract given in twelve cases with the best results. The patients suffered from the usual nervous condition, the result of oöphorectomy or normal menopause. No disagreeable effects from the exhibition of the drug in tabloids, and no constitutional disturbance were noted. Improvement in the symptoms began after the lapse of about forty-eight hours, and cure was complete within a month. Mond (*Münch. med. Woch.*, No. 36, '96).

Successful treatment by fresh ovarian tissue of climacteric disturbances following castration. The dose was 77 grains twice a day, gradually increased to 310 grains, the general condition of the patient and the character of the urine being watched carefully. The treatment was continued for eighteen days, before which time any temporary stoppage of the drug was followed by an increase in frequency of the attacks of dizziness, flushing, and palpitation. After the eighteenth day the stoppage did not cause any trouble, and the patient was discharged suffering from only four or five light attacks daily that did not cause her any inconvenience. F. Mainzer (*Deut. med. Woch.*, Mar. 19, '96).

By use of ovarian extract disagreeable symptoms of the natural menopause are relieved or disappear. It rapidly overcomes the metrorrhagia of the menopause not connected with new growths. Results of treatment are usually apparent on the second or third day. Preparations in wine preferred, daily dosage being 5 drachms, containing 3 grains of ovarian extract. Jacobs (*Dublin Jour. Med. Sci.*, Sept. 1, '97).

Oöphorin preparations given to women suffering from acne rosacea and cutaneous disorders at the menopause, with satisfactory results. E. Saalfeld (*Berliner klin. Woch.*, No. 13, '98). (See also ANIMAL EXTRACTS, in volume i.)

Effects of ovarian tissue, administered in tablet form, on symptoms due

to the removal of both ovaries, in a series of 28 cases. In 6 the symptoms entirely disappeared. In most of these there was flushing, sweating, and giddiness, while mental disturbances of a mild nature were noted in a few. In 4 cases considerable improvement and in 9 others slight improvement was experienced. In one of the last-mentioned group the chief symptoms were mental, and probably were independent of the removal of both appendages undertaken for pyosalpinx; the remaining 8 cases were not influenced by the administration. Each patient received at first 1 or 2 tablets three times a day for one to two weeks. In no case was any ill effect observed. Although the beneficial effect is not constant, the number of good and fair results justify the writer in recommending its use. In view of the distressing sensations complained of after double oöphorectomy, the operator should always endeavor to leave some ovarian tissue behind when performing this operation. A. Flockemann (Münchener med. Wochen., Nov. 26, 1901).

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MENORRHAGIA. See UTERUS (UTERINE HÆMORRHAGE).

MENTHA.—Two varieties of mentha, *mentha piperita* and *mentha viridis* are employed in medicine.

Mentha Piperita.

Mentha piperita, or peppermint, is the leaves and tops of *Mentha piperita* (order *Labiata*): a plant indigenous to Great Britain, but naturalized in the United States and many other countries. It has an aromatic odor and taste, and contains a volatile oil, from which is obtained menthol, the so-called peppermint-camphor. The oil of peppermint is soluble in alcohol, ether, and chloroform.

Preparations and Doses.—Aqua menthæ piperitæ, $\frac{1}{2}$ to 2 ounces.

Oleum menthæ piperitæ, 1 to 5 minims.

Spiritus menthæ piperitæ, 10 to 30 minims.

Trochisci menthæ piperitæ ($\frac{1}{8}$ minim of oil), 1 to 5 troches.

Therapeutics.—The bruised fresh leaves, or the fresh leaves made into a poultice, are useful domestic remedies for the relief of colic, sick headache, nausea, and painful affections (colic, rheumatism, etc.). Peppermint-water is used as a flavoring to cover the taste of nauseous medicine, and as an antispasmodic to lessen the griping effect of certain remedies. It is a popular remedy for colic and flatulence in infants, especially when combined with a small dose of bicarbonate of soda (soda-mint). The spirit and troches may be used for the same purposes in adults. The oil has analytic properties, and may be painted over the course of the nerves, in neuralgia, and over the painful joints in arthralgia. Evaporation should be prevented by covering with oiled muslin. It is also useful in myalgia and chronic gout.

In toothache a pledget of cotton, wet with the oil and inserted into the cavity, will give relief, acting both as an antiseptic and an analgesic.

The troches are useful to disguise the breath, or as a carminative and stimulating stomachic.

In acute rheumatism the oil may be applied to the painful joints and covered with cotton and oiled muslin.

Inhalations of the oil have been recommended in pulmonary tuberculosis, but clinical experience seems to show that its value is slight.

Mentha Virides.

Mentha virides, or spearmint, is the leaves and tops of *Mentha virides*. It is a widely-distributed variety of mint, possessing properties similar to those of pep-

permint, but, being less powerful, is often preferred for children. The active principle is a volatile oil.

Preparations and Doses.—Aqua mentha virides, $\frac{1}{2}$ to 2 ounces.

Oleum mentha virides, 1 to 5 minims.

Spiritus mentha virides, 15 to 40 minims.

Therapeutics.—The preparations of spearmint are used in the same manner and doses as those of peppermint. Their taste, is, perhaps, less agreeable, but they are often found to be more acceptable to the stomach. Several other species of mint are used in medicine, though non-official. These have properties similar to those of peppermint and spearmint.

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MENTHOL.—Menthol is the stearopten from the essential oil of *Mentha piperita*. It occurs in colorless crystals, having a strong peppermint odor. It is soluble in alcohol, ether, bisulphide of carbon, oils, and acetic acid, and is very slightly soluble in water. It melts at 110° F. It may be fused or compressed into cones or pencils. Chinese and Japanese oils of peppermint are richer in menthol than the official oil. Menthi-dol is a mixture of 4 parts of menthol and 1 part of iodol, usually molded into cones or pencils, and used the same as menthol. Mentho-phenol is obtained by mixing 1 part of phenol and 3 parts of menthol, and then melting the mixture; it is antiseptic and analgesic.

Physiological Action.—Menthol in the frog paralyzes the spinal centres, then the nerve-trunks; small doses excite, while large doses paralyze, the heart and cause the respiration to become shallow and slow. There is irregular reduction of blood-pressure and loss of sensibility, the animal growing quite cold. Binet re-

cently showed that menthol was not eliminated by the lungs, as was at one time believed to be the case.

The sensation of cold produced by menthol when applied locally was shown by Goldscheider not to be due to actual lowering of the temperature of the surface. In fact, the application of a solution of menthol he found to be followed by a rise of 2° C. He, therefore, attributes the sensation to the influence of the drug upon the peripheral nerves of sensation: an action quite independent, also, of evaporation.

The action of menthol is to dissociate four kinds of sensibility to cold, heat, contact, and pain, respectively. The influence upon the nerves of pain is the earliest, then follows an excitation of those of cold; next those of touch are paralyzed, and finally, the drug is very vigorously used, the heat nerves are acted upon, and the sensation of prickly heat results. The writer considers that these results point to the specific origin of the four kinds of nerves, those of heat and cold being stimulated, while those of touch and pain are depressed by menthol. This is in harmony with the view of von Frey and Thunberg, that the latter sets are the most superficially arranged, the nerves for cold coming next, and those for heat lying deepest. Ioteyko (Journ. de Neurol., May 20, 1903).

Therapeutics.—**GASTRO-INTESTINAL DISORDERS.**—Menthol may be given in doses of 3 to 5 grains in capsules for the relief of nervous dyspepsia and diarrhœa. It has also been used in the dose of 1 or 2 grains as a sedative in gastralgia. It is, however, contra-indicated if there is present any acute inflammation of the stomach.

Menthol has been used in the vomiting of pregnancy. Hourly doses of a teaspoonful of the following are recommended by Hare:—

℞ Menthol, 15 grains.
Whisky, 6 drachms.
Syrup, 1 ounce.—M.

Gottschalk's formula is:—

℞ Menthol, 1 part.
Alcohol, 20 parts.
Distilled water, 150 parts.

Weil's formula:—

℞ Menthol, 1 part.
Olive-oil, 4 parts.
Dose, 10 drops, with powdered sugar.

Squibb's formula:—

℞ Menthol, 40 parts.
Oil of bitter almonds, 180 parts.
Dose, 6 to 10 drops on loaf-sugar.

Case of a woman who had vomited after each meal for three weeks relieved at once by the use of menthol. In order that the drug may remain in solution it may be given in the following form: Menthol, 1; dissolved in spirit vini, 20; syr. sacch., 30. Of this mixture a teaspoonful is given every hour. L. Weiss (Wiener med. Woch., p. 496, '90).

The following may be used in case of the vomiting of tuberculosis:—

℞ Menthol, 4 grains.
Syrup, 5 ounces.—M.

Shake well before using and give two or three teaspoonfuls at short intervals after each meal.

This treatment is an excellent one to follow the use of chloroform-water or ice. Editorial (Jour. des Prat., Jan. 9, '97).

Following mixture recommended to control the vomiting of seasickness:—

℞ Menthol, 1.5 grains.
Cocaine hydrochlorate, 3 grains.
Alcohol, 2 ounces.
Simple syrup, 1 ounce.

One teaspoonful is to be given every half-hour until several doses are taken. A. Morel-Lavallée (Le Bull. Méd., vol. x, p. 1199, '98).

PAINFUL DISORDERS. — For the relief of pain and pruritus, menthol is an efficient remedy applied in the form of a cone or pencil, in alcoholic solution, or

in ointment. One drachm of menthol may be dissolved in 4 ounces of soap liniment for external uses. The pain and itching of herpes zoster and urticaria may be relieved by a 5-per-cent. ointment of menthol.

Following prescription to be used for the internal administration of menthol in hemicrania, infra-orbital neuralgia, cephalalgia, rheumatism, and in sciatica. The dose varies from 4 to 15 grains:—

℞ Menthol, 2 drachms.
Alcohol, 1 ounce.
Glycerin, 1 ounce.
Syrup, 1 ounce.

M. Sig.: One teaspoonful in warm water when required. McLaury (St. Louis Polyclinic, June, '89).

Menthol used with success in all pruriginous affections of the skin, especially when aggravated by scratching, as in urticaria, some varieties of eczema, and scabies. It may be prescribed in a 5-per-cent. alcoholic solution, a 10-per-cent. oily solution, ointments of 1 to 6 per cent., and powders of 2 to 6 per cent. Care must be taken not to apply too-concentrated solutions to the irritated surfaces or the mucous membranes, as a very intense sensation of burning may be caused; and also not to make too extensive applications at once, on account of the disagreeable sensation of cold. As the itching is but a symptom of the disease, it is necessary to prescribe for the latter, as the menthol relieves only the itching. Colombini (Wiener med. Presse, May 7, '93).

NASO-LARYNGEAL DISORDERS.—Menthol may be used as a depletant on the mucous membranes of the nose or throat. It causes a contraction of the local blood-vessels, which, unlike the action of cocaine, is not followed by an increased dilatation. Dissolved in oil (6 grains to 1 ounce) or in albolene or blandin (5 grains to the ounce) it may be used in spray for the relief of acute coryza and the nasal form of hay fever. A mixture of menthol and carbonate of ammonium may be used for the same purposes, either

being inhaled from a wide-mouthed bottle or an inhaling-tube.

Thirty-seven cases of diphtheria (in 3 adults and 34 children) treated successfully by painting with a 10-per-cent. alcoholic solution of menthol. The paintings (using cotton-wool) were usually carried out three times daily. In some cases, however, a single free application was followed by complete disappearance of false membranes within two days. A marked improvement in the patients' general condition was invariably noticed from the beginning of the treatment. F. Kastorsky (Wratsch, No. 24, '94).

PULMONARY DISORDERS.—Inhalations of menthol have been used with advantage in asthma. Being readily volatilized by the addition of hot water, the resultant vapor may be inhaled.

A few drops of a 20-per-cent. solution of menthol in olive-oil by inhalations administered to a woman with asthma and congestion of the head. Before administration crepitation and rhonchi were heard on pulmonary auscultation. The remedy always checked the asthmatic attack; breathing became normal, the heart's action remained unaltered, and the pulse full and strong. The patient sometimes complained of dizziness. Jores (Ther. Monats., Apr., '89).

Intralaryngeal injections of 10- to 15-per-cent. solutions of menthol in olive-oil or vaselin have been used in pulmonary tuberculosis and ulcerations of the larynx. These injections often relieve the dyspnoea and cough associated with phthisis.

Injection into the larynx of a 20-per-cent. solution of menthol in olive-oil advised in laryngeal and pulmonary phthisis. At each sitting two to three injections of 15 minims each should be given, the fluid being deposited on the part affected when the larynx is diseased, but in the trachea when the lungs only are involved. The procedure should be carried out once or twice daily for about two months. Ulcers of the larynx heal nicely under it. A. J. Beehag (Edinburgh Med. Jour., Jan., '88).

Menthol successfully employed in the treatment of pulmonary and laryngeal tuberculosis, according to the suggestions of Koshlakoff and Simanovsky. In 8 out of 12 cases it was found that: (1) the menthol treatment was followed by a great amelioration of the general condition of the patient; (2) the remedy improved the appetite, promoted easy expectoration, and gradually decreased the daily quantity of the sputa; (3) the drug never gave rise to any renal irritation; and (4) it never induced hæmoptysis. In the 15 cases of laryngeal tuberculosis treated with menthol, the drug was found to possess considerable analgesic action. The paintings decreased local inflammatory phenomena and did away with infiltrations. They also promoted healing of superficial ulcers, but could not, however, bring about cicatrization of deep ulcerations. It is advisable always to begin with a 10-per-cent. solution, and to gradually increase this strength. In all cases the local must be accompanied by general treatment.

In pulmonary tuberculosis the drug was administered internally, as in the following prescription:—

℞ Mentholi, 1 drachm.

Pulv. acaciæ sacchari albi, of each,
1/2 drachm.

M. et ft. pil. No. 40.

Of these pills, 5 are to be taken, gradually increasing the number to 20, 30, and even 40. The inhalations were used from ten to twelve times a day. The paintings were applied with from 10- to 50-per-cent. solution, once daily, once every two days or twice a week, according to indications. Valerius Idelson (Wratsch, No. 3, '90).

Attention called to the parasitocidal powers of menthol, a remedy that may be daily applied through the trachea in the treatment of pulmonary consumption, using doses of 1 drachm of a 12-per-cent. solution made with sterilized oil. Administered in this manner, the drug was well borne by patients, and under its use the cough, expectoration, night-sweats, the hectic fever, and even the emaciation were diminished. Brookhouse (Revue Gén. de Clin. et de Thér., Aug. 3, '92).

EAR DISEASES.—Mentholized oil (10 to 15 per cent.) has been recommended in the treatment of furuncle of the external auditory canal, and of diffuse swelling of the wall of the canal. A pledget of cotton soaked in the mentholized oil is inserted into the meatus and left for twenty-four hours. A burning sensation is produced, but it soon passes off. In the painful stage of otitis media without perforation, mentholized oil (1 to 2 per cent.), instilled into the meatus, is a useful anodyne application. In chronic otitis media mentholized oil (5 to 10 per cent.) is valuable as a mild antiseptic for the interior of the tympanum.

LOCAL ANÆSTHESIA.—Squibb advises the following solution for local anæsthesia that will last about five minutes, an ordinary hand-spray apparatus being used:—

R Menthol, 2 parts.
Chloroform, 20 parts.
Ether, 31 parts.—M.

Equal parts of chloral and menthol form, upon trituration, an oily substance which is mildly counter-irritant and a local anæsthetic.

Mixture of equal parts of menthol and iodoform in the form of a dry powder tried in fourteen cases of scraping out and resection of tuberculous bones and soft parts. In every instance the wound healed more rapidly, and the general course of the case was more favorable than in another series of similar cases where iodoform alone was employed. Girard (Brit. Med. Jour., Apr. 28, '88).

C. SUMNER WITHERSTINE,
Philadelphia.

MERCURY.—Mercury, *hydrargyrum*, or quick-silver, is a lustrous, bluish-silver-white metal liquid which, though occasionally found in its pure state, is usually obtained from native chloride or

sulphide. It is also found in amalgamation with silver. The sulphide, called *native cinnabar*, is mainly obtained in the mines of Almaden, Spain, and of New Almaden, near San Jose, California. The various processes through which it is isolated are all based upon distillation.

Mercury is devoid of odor or taste. At the usual temperature of temperate countries it occurs as a heavy fluid, but at 38.88° below zero F. it becomes solid, though quite malleable. When it is exposed to high heat (675.05° F.) it volatilizes into a colorless vapor. It is soluble in nitric acid and boiling sulphuric acid.

Physiological Action.—**BLOOD.**—Wilbouchewitch showed that large doses of mercury caused reduction of the red blood-corpuscles and that small doses prevented their destruction. When, however, small doses were administered during too prolonged a period, anæmia was again observed. E. L. Keyes, in a series of experiments, further demonstrated that small doses of mercury not only arrested the destruction of corpuscles due to syphilis, but that they actually caused an increase which steadily progressed until a normal proportion was attained, as long as the small doses were given. Large doses he found to exert an opposite influence, being distinctly debilitating. Robin, acting on these conclusions, found that in syphilitic or non-syphilitic subjects, and whatever way it was administered, mercury always caused an increase of blood-corpuscles provided an intercurrent gastric disorder were not present or the untoward effects of mercury—salivation, etc.—were not produced. The onset of these disorders marked the beginning of hypoglobulia—decrease in the number of corpuscles.

Observations in regard to the amount of hæmoglobin present in syphilis in relation to the benefit derived from mer-

curial treatment. Three incontestable facts are (1) that if a syphilitic patient has no treatment, the quantity of hæmoglobin in the blood will diminish from time to time; (2) that if mercury be given to animals or persons not suffering from syphilis, the amount of hæmoglobin will be diminished in a few days; (3) that if a syphilitic person who shows that the amount of hæmoglobin is diminishing be put on a mercurial treatment, an increase in the amount of hæmoglobin can be determined at once, and very markedly in the course of seven or eight days. From these facts we have a valuable indication as to just when our mercury ceases to do good, and therefore should be stopped. Semmola (*La Presse Méd.*, Sept. 15, '89).

The comparative influence of mercury upon the blood was recently studied by Kuperwasser (*Arch. des Sci. Biol. de St. Petersburg*, vol. vi, '98). He found that white corpuscles (which all arise from one and the same element,—namely: the small mononucleated lymphocyte) being classified into (1) young, (2) mature, and (3) old, leucocytes, the blood of healthy subjects was modified by mercury in that the proportion of young leucocytes present is considerably increased and that of the old considerably diminished. The blood of syphilitics reacts to mercury by a considerable diminution in the proportion of young and a corresponding increase in that of old leucocytes. This reaction is independent of the stage of the disease, and takes place whether there are at the time syphilitic manifestations or not, and also whether the patient has or has not previously been subjected to specific treatment of mercury and iodides. Those who have undergone treatment by mercury within four months of applying the blood-test form the only exception to this rule. In such cases the reaction of syphilitic is replaced by that of healthy blood, possibly because the patient still retains a con-

siderable quantity of mercury, or because under its influence the disease has become so attenuated that the blood gives a normal reaction.

Older observers had noted a diminution of fibrin, and as a result an abnormal fluidity of the blood that predisposed to hæmorrhage. Lowering of the rate and tension of the pulse and of the temperature, sometimes of nearly two degrees, was also noted: all evidences that the remedy had been administered in injudicious doses.

Bichloride, in high toxic doses, exercises a noxious influence on both the white and red cells of the blood. In small amounts it affects the white corpuscles more markedly than the red bodies. The minimum fatal quantities for the organism correspond to the smallest amounts necessary to destroy the leucocytes; the same relation exists in regard to the largest quantities tolerated by the economy and those which are borne by the leucocytes; and it can be said that at present there is no histological element so susceptible to the influence of the drug in question as human leucocytes. E. Maurel (*Bull. Gén. de Thér.*, Mar. 15, '93).

KIDNEYS.—The observations of Welander tend to show that the elimination of mercury through the kidneys is attended by more or less temporary irritation when the drug is administered for some time. Casts were found in the urine in all of his 97 cases, in proportion to the length of the treatment, gradually decreasing after cessation and disappearing within a month or six weeks. It is well to bear in mind, however, that his data are based upon observations in syphilitic cases, and that the disease may bear considerable influence upon the renal phenomena.

Syphilitic patients under mercurial treatment frequently develop nephritis. Out of 100 patients, 8 had developed albuminuria in consequence of the absorption of mercury. These cases always

tended to recovery on the cessation of the drug. Fürbringer (Med. Week, July 13, '94).

As regards the quantity of urine, various preparations were found, by Winternitz, to differ in no way. His experiments included the insoluble salts, calomel, salicylate of mercury, and the soluble preparations. A parallelism between the quantity introduced and the curative effect was shown by the quantity excreted, whether the mode of administration was by the mouth, subcutaneous injection, local inunction, or plaster.

Study of elimination of mercury in 28 cases: 1. It is eliminated by sweat as well as by urine. When mercury is introduced in the system in quantity the elimination is increased; with cessation of the drug, elimination is diminished. 2. Mercury is eliminated by the skin in larger amounts than is supposed. The eliminated amount depends upon the amount of sweat. 3. During inunctions mercury is pressed in the glandular ducts, whence it is removed by sweat. 4. By forced sweating the remaining Hg can be removed from the system. V. V. Mironowicz (Vratch, vol. xx, No. 28, '99).

INTESTINAL TRACT.—Schuster, as already stated, found mercury in the *faeces* three months after cessation of the treatment. This author is of the opinion that the intestinal tract is far more active than the kidneys in the process of elimination, and that mainly through its means the system is, as a rule, relieved of its mercury six months after an average course of treatment. In poisoning by mercury the intestinal tract seems to bear the brunt of the attack, especially the large intestine. Pilliet and Cathelineau found extreme congestion of the vascular net-work, with necrosis of the glandular net-work, in this situation. Fränkel found that the inflammation, even when mercury is used externally, attacked the large intestine and the ileum only exceptionally.

Calomel has a marked disinfectant effect upon the intestinal canal, which depends upon the transformation of the drug into an oxide of mercury through the influence of the bile and the alkalies of the intestinal canal. Sawadsky (Jour. des Sci. Méd. de Lille, Mar. 16, '88).

Anatomical specimens from a patient who had received hypodermic injections of metallic mercury. The intestine was dotted with numerous ulcers and diphtheroid thickenings, and the kidneys were of the small, white type. Audry (Lyon Méd., Apr. 15, '88).

When calomel is given, even in therapeutic doses, and the subject is then made to drink saline or chlorhydrated water, much more rapid and intense symptoms are induced than when the calomel is administered alone.

In these cases it is probable that the calomel only acts while going through the albuminoid substances of the body; it irritates the digestive tube, giving rise, in the first place, to diarrhoea and vomiting and afterward to alterations in the mucous membrane. This toxic and irritating action of the calomel is, however, principally observed when it is in contact with substances which render it more soluble and more absorbable. Among these substances, chloride of sodium and chlorhydric acid, associated with various albuminoid substances, come first in order. These substances do not act by chemically transforming the calomel into a more toxic agent,—i.e., corrosive sublimate,—but simply by facilitating its absorption in a mass. Ottolenghi (Gaz. Osped., No. 1, '97).

NUTRITION.—Thirty years ago Liégeois stated that his observations had led him to conclude that even in healthy men very small doses of mercury led to an increase of weight. Schlesinger, in a series of experiments in sheep, rabbits, and dogs, also noted this fact. Having administered the corrosive sublimate an entire year, he found that all the animals, especially the dogs, so treated had gained in weight and that there had been a marked increase of red corpuscles, while all the untreated check animals did not

present these changes. Schlesinger contends, however, that the increase in weight being due to an increase of fat, the only conclusion warranted is that a diminution of oxidation occurs, the result of restricted protoplasmic metabolism, the red cells increasing merely because the destruction was curtailed. The tonic effects of mercury would thus, in his opinion, be but apparent; were they real an elevation of temperature and an increase of organic exchanges would be present. In the opinion of H. C. Wood, this view rests upon theory rather than upon demonstrated facts, there being much clinical testimony to sustain the assertion that exceedingly minute doses of mercury benefit nutrition. The fact that von Boeck found an increase—though slight—of nitrogen in the fæces and urine under mercury tends to sustain Wood's contention.

ABSORPTION AND ELIMINATION.—Although there is no doubt, whatever that mercury is absorbed and eliminated, the manner in which the process is carried on is not fully understood. H. C. Wood concludes from data at hand that "the single dose of mercury does not remain in the system, but that when the drug is administered constantly for a length of time elimination does not keep pace with absorption, so that the mercury accumulates in the tissues."

When applied to the skin, mercury has been traced microscopically as far as the hair-bulb, where it has thought until recently to become transformed into corrosive sublimate (Neumann). The same chemical transformation was believed by many observers, including Nothnagel and Rossbach, to occur in the intestinal tract. In the presence of albuminous substances the new salt was credited with the power of forming an

insoluble albuminate, which became soluble in the presence of chloride of sodium.

Recent labors, however, having demonstrated the extreme power of volatilization of mercury (it has an initial molecular velocity of 180 metres per second, according to Merget), and the theory has been vouchsafed that in its normal or metallic state it penetrated the cutaneous and intestinal mucous surfaces (Rabuteau; quoted by Jullien, "*Maladies Vénériennes*," p. 1161). The protiodide, for instance, would become transformed into metallic mercury and biniodide, the latter, in turn, being decomposed and giving rise to the iodide of sodium found in the urine; calomel would yield pure mercury and bichloride, which, in turn, would slowly be transformed into chloride of sodium and metallic mercury in the blood. Thus, any preparation of mercury would finally yield its original element. This theory, according to Jullien, of Paris, a syphilographer of extensive experience, is sustained by much clinical evidence. He alludes to the many instances in which metallic mercury has been found in various tissues (Van Swieten), the pus of abscesses (Maldore), bones (Hyrtil), etc.

As regards the accumulation of mercury in the organism, Vajda and Paschikis and Sigismund found it in the urine thirteen years after cessation of mercurial treatment, but Schuster attributed this result to faulty technique in the case of the first observers and to constant exposure of the subject to diffused mercury, in the case of Sigismund. Still, Schuster himself found it in the fæces months after the treatment has been stopped.

In administration of the insoluble salts of mercury the metal may be found deposited in the following organs, those containing the larger amounts being first: Kidneys, liver, spleen, then the intestinal

canal (which contains an increasing portion from the upper part downward), and in small amounts in the heart skeletal muscles, and, in some cases, in the lungs and in the blood collected in the larger vessels and the aorta. Karl Ullmann (Inter. klin. Rund., Sept. 25, '92).

As to its elimination, this depends upon the manner in which it is administered. Byasson and Betelli found mercury in the urine and saliva two hours after ingestion. Riederer obtained, from the fæces of a dog, 77 per cent. of the quantity administered during thirty days, and from its urine 1 per cent. The brain, heart, lungs, spleen, pancreas, testicles, penis, muscles, and liver were all found to contain mercury: the liver the most and the muscles the least. It has also been found in the milk of nursing-women, and their sucklings, and in semen. The experiments of Magençon and Bergeret would tend to show, however, that a single dose of mercury is completely eliminated.

After poisoning a rabbit with mercury, the writer found the metal in the blood and lymph; also in the walls of the intestine, in the state of insoluble sulphide. This is due to the action of sulphuretted hydrogen in the intestine combining with the metal. The granules of mercury may be carried by the leucocytes between the epithelial cells of the intestine. Other granules are found in the walls of the blood-vessels. If these granules are numerous enough to obstruct the circulation, they may cause necrosis and ulceration. The amount of sulphide of mercury precipitated is not proportional to the amount of mercury introduced, but to the amount of sulphuretted hydrogen produced in the intestine. It is probable that mercurial stomatitis is due to a similar process. Mercury is also found in the kidneys, especially in the convoluted tubules. Almkvist (Nord Med. Arch., Nov. 6, 1903).

Untoward Effects of Mercury.—When there exists in the individual treated an

unusual sensitiveness to mercury or the drug be given too long or in excessive quantities, symptoms appear that are quite pathognomonic. There is, at first, disagreeable metallic taste, the breath is foetid,—the foeter of dead tissue,—the gums are sensitive, and when the jaws are forcibly closed slight pain is experienced. At the same time the saliva becomes more free than usual. If as soon as these symptoms appear the administration of the drug is not stopped, *as should always be the case*, the gums become spongy and bleed easily; the tongue swells, and the flow of saliva becomes excessive,—ptyalism. If the gums be examined, a dark line will be found at their junction with the teeth. The parotid and maxillary glands are usually enlarged and tender, and there may be slight fever.

Case of salivation in a child from less than 2 grains of calomel. Krotoszyner (Occidental Med. Times, Mar., '96).

Persistence in the use of mercury after these manifestations is followed by local destructive changes. Ulceration of the mucous membrane, soon invading the deeper tissues, looseness and loss of the teeth, necrosis of the jaw-bones, copious hæmorrhages occurring through ulceration of the vascular coats, follow in more or less rapid succession, and the patient dies of exhaustion. It is rare that such a result occurs nowadays. The cases of mercurial poisoning usually met with are usually due to insufficient instructions to the patient, who continues to use the remedy without consulting his physician.

In some cases the skin is first to show the mercurial manifestations, an eruption resembling that of scarlatina being that most frequently observed. Great suffering is sometimes entailed, as shown in Camescasse's case given below.

Instance of erythema scarlatinoides following the application of mercurial ointment to the pubic region in which diagnosis of scarlatina was made by a physician. Within a week there followed abundant desquamation from the entire body, especially profuse on the hands and feet. At no time was there an elevation of temperature nor was the throat implicated. Fordyce (*Jour. Cut. and Gen.-Urin. Dis.*, Dec., '95).

Case of an old woman, suffering from irregular heart-action resulting from a long-standing mitral insufficiency who received five doses of $\frac{2}{3}$ grain of calomel at three-hour intervals on alternate days for a week. Patient was upon a milk diet, and received a simple clyster each morning. Moderate purgation and considerable diuresis ensued, with consequent diminution of anasarca and dyspnoea. Upon the day following the first day's use of the drug there was noticed a slight burning over the entire body, but especially over the face, neck, and hands. The second day redness appeared. At the end of the week the burning was atrocious, the entire surface of the skin was scarlet red, violet in places, swelled, and thickened. The hairy scalp remained uncolored. The palms and soles were less colored than the other surfaces, but yet were red. In a few days spontaneous cure appeared, but accompanied by an abundant and extraordinary desquamation, which extended to the hairy scalp and to the mucous surfaces. First, large surfaces were detached, then small scales, and finally a whitish powder. This process lasted fifteen days, although the mucous surfaces were healed at an earlier period. There was not any elevation of temperature, nor did the redness of the mouth resemble a mercurial stomatitis. Camescasse (*Bull. Gén. de Thér.*, le liv., p. 20, '98).

Case of a woman who was confined March 18th. When she was seen first—about ten days later—there was evidence of septicæmia, and she was accordingly given a douche consisting of one gallon of a 1 to 4000 solution of mercury bichloride. When seen two or three days later, there was excessive ptyalism, with swelling of the gums. Mercury

had not been used in any other form, and there had been perfect drainage. T. R. Mansfield (*Jour. Amer. Med. Assoc.*, July 14, 1900).

Case of localized gangrene following an extremely painful intramuscular injection of the bromide of mercury. Brocq has reported a similar result after a painful injection of the bromide, and Lesser had gangrene occur after two injections of mercury bichloride, which were followed by profuse bleeding. The author expresses the view of Brocq that the gangrene was due to a direct injury of the nerve, while Lesser ascribes the condition to the injury of a large blood-vessel. Pflüger (*Archiv f. Derm. u. Syph.*, lx, p. 425, 1902).

A woman, aged 31, had an eruption over the whole body, which, at first, was supposed to be syphilitic, and was boldly treated with mercury. The patient was freely salivated several times and, as a result, she suffered from partial suppression of urine and œdema. The urine contained 1.4 per cent. of albumin, and a large number of hyaline and granular casts, and renal epithelium. It was subsequently discovered that the skin eruption was not due to syphilism, and, consequently, the mercurial treatment was stopped. The amount of albumin in the urine diminished eventually to 0.025 per cent.; at this point it became permanent. The urine was examined for mercury, at short intervals; it was found to be continuously present for one year and twenty-nine days after the last dose had been administered. J. W. Swan (*American Jour. Med. Sci.*, Jan., 1904).

Untoward symptoms of mercurial poisoning do not only manifest themselves as a result of the therapeutic use of mercury; they are often brought about by the handling of mercury as an occupation or the inhalation of its fumes. This is termed "chronic mercurial poisoning."

CHRONIC MERCURIAL POISONING.—When the metal is inhaled in the form of a vapor, the nervous system is most apt to suffer, and paralysis is a frequent sequel. The palsy may, after long ex-

posure, come on suddenly or slowly; there is a sort of general tremor and great unsteadiness in all movements, including those involved in locomotion, and the skin becomes dark yellow or brown. Mental debility may appear, the precursor of an early demise. The manifestations often simulate chorea and paralysis agitans. The disease may assume various special forms, certain parts being more involved than others. In some wrist-drop is a marked feature, in others there may be a brachial or crural monoplegia, etc. The special senses are often impaired and disorders of sensation are frequently observed. Neuralgia is a prominent feature of these cases.

Case of typical polyneuritis following a prolonged course of inunction of mercury in the treatment of an attack of syphilis. Leyden (*Deut. med. Woch.*, Aug. 3, '93).

Three cases of pronounced multiple neuritis from the therapeutic use of mercury. Recovery occurred in all. Spillmann and Etienne (*Rev. de Méd.*, Dec. 10, '95).

MERCURIAL CACHEXIA.—This condition resembles scurvy and may result from professional exposure to the effects of mercury or as a sequence of treatment. There is marked anæmia and loss of flesh, alopecia, general loss of power and all the local manifestations of mercurial toxæmia: foul breath, diarrhœa, and a dark color of the skin. There is, besides, intense pain in the bones and joints, suggesting rheumatism.

Poisoning of Mercury.—Whatever be the preparation of mercury ingested in poisonous quantities, the symptoms are very similar, the only difference worth noting being the rapidity of onset. The majority of accidental cases met with are usually instances of bichloride poisoning. If the dose taken is large and concentrated, there is nausea, vomiting, faintness, impaired locomotion, and severe

pain in the throat and chest. There is violent diarrhœa, cramps; at first the urine is freely voided; later on anuria occurs. The lips, tongue, and pharynx may be tumefied, and dysphagia be so marked as to prevent swallowing of remedies. After several hours the breath becomes excessively fœtid, great salivation occurs, and ulcers appear on the inner aspect of the lips and cheeks, and sometimes the tongue. The gums become spongy. Gradually the local symptoms become more marked and the patient dies. A fatal ending rarely occurs the same day.

Case in which a woman was poisoned through drinking, at one draught, a tumblerful of tepid water, in which a 5-per-cent. sublimate pastille had been dissolved. Immediately after drinking this she felt nausea, faintness, and weakness in the knees, so that she could not even crawl into bed. Directly she was placed in bed violent choking sensations set in and she vomited bile-stained mucus. One hour and a half after the poison was swallowed the symptoms mentioned had become aggravated. General trembling movements, especially marked in the upper part of the body, were present. The patient could not speak, but by signs expressed that she felt severe pains in the region of the stomach and pharynx and heaviness in the head. The pulse was rapid and soft, the temperature subnormal, the pupils contracted. She had taken a quart of milk, but found great difficulty in swallowing it. The whites of 3 eggs were given at once, morphine, and, later on, oil of camphor, being injected subcutaneously. The doses of albumin were continued every half-hour during the day. Temporary suppression of urine was noted, but the kidneys acted within twenty-four hours; tea and black coffee favored diuresis, but these fluids were usually vomited shortly after they were swallowed. The symptoms were very grave for several days. The vomiting ceased gradually; profuse salivation and ulcerative stomatitis set in on the third day, with bloody and slimy motions and

scanty secretion of urine. Albumin and, occasionally, blood were detected in the urine. It was a fortnight before the patient was able to stand. She had become extremely emaciated, lost a great quantity of hair, and noted that her sight failed her. In about a month the patient was convalescent. Eisenhart (Centralb. f. Gynäk., Dec. 13, '90).

Several cases of mercurial poisoning observed. A blue line was present upon the gums, very similar to that found with lead. This fact is not generally referred to in literature, which is the more remarkable, since, from the appearance alone, it is hardly possible to distinguish it from the lead line. The history and other symptoms must be taken into account. D. Gilbert (Bull. de l'Acad. Royal de Med. de Belg., Tome xvii, No. 6, 1903).

In a fatal case, that of a woman who had taken upon an empty stomach a large teaspoonful of corrosive sublimate in powder, Durante found the following anatomical changes: Subpericardial ecchymoses; enlarged liver, with subcapsular ecchymoses; pale, swelled kidneys, with small ecchymoses in the pelvis; œsophagus reddened at its upper part, normal below; stomach showed a softened mucosa, with numerous ecchymosed patches and large, grayish ulcerations, most marked near the fundus; intestinal mucosa showed limited areas of deep reddening, with ulcerations, the changes in the large intestine being less than those in the ileum; the brain showed injection of the vascular meninges.

Local applications of various preparations of mercury are no less toxic than when the drug is taken by the mouth.

Case of girl, aged 20 who sprained her wrist. A few days later lymphangitis apparently supervened, for which mercurial ointment was applied and rubbed into some cracks on the hand. An hour after the inunction the patient felt ill, fainted, and vomited. The same evening, there was much swelling of the hand and of the arm on its dorsal aspect. An in-

cision was at once made into the brawny and gray-colored tissues. The next day, January 16th, there was vomiting, with tenesmus and slight albuminuria. Cultivation experiments were negative. On January 17th the vomiting was less frequent, but there was anuria. The stools were blood-stained, and the condition very like that of dysentery. There was no fever. On January 18th severe hæmatemesis occurred. Diarrhœa, with stools of almost pure blood, and anuria continued. On January 19th there were gangrenous gingivitis and glossitis, with moderate salivation. The prostration was great, but the mind remained clear. The following day there was a feeling of weight, and then paralysis, in the extremities, and the patient died. There were small hæmorrhages and superficial sloughs in the mucous membrane of the lower part of the small intestine and the characteristic appearances of severe dysentery in the large intestine. In the kidneys there were well-marked necrotic changes in the epithelium, especially of the convoluted tubes. Sackur (Berliner klin. Woch., June 20, '92).

The recommendation of preparations of mercury for vaginal douching is attended with danger, owing to the large quantity of fluid injected. Rectal injections are still more dangerous, owing to the rapidity with which fluids are absorbed.

Patient injected into the rectum a solution of perchloride of mercury (B. P.) —1 in 2000—which had been ordered for the preparation of a vaginal douche. In half an hour she was seized with cramp-like abdominal pains, and a little later she was found collapsed and pale, with a rapid intermittent and weak pulse, the jaws tightly clenched, the eyes dull and anxious. She recovered within a week, though complaining of her teeth and gums. Salivation never occurred. Hall (Lancet, Jan. 9, '97).

Treatment of Poisoning by Mercury.—Albumin forms an insoluble albuminate of mercury; hence the whites of several eggs should at once be administered to the patient. As the albuminate is liable

to be disintegrated after a certain time, however, the stomach should be evacuated soon after and washed out, using the stomach-pump. As soon as this is done more white of egg should be administered and left *in situ*. If none can be had, wheat-flour or milk may be used, the former being given with a little water, just enough to enable it to reach the stomach promptly. After this measure the symptoms are to be treated on general principles as they appear.

Three drachms of yellow oxide of mercury with 1 of the red, accidentally taken by a man, produced in three minutes violent vomiting, followed by diarrhœa. Milk and eggs were given, and the man recovered. Herbert G. Lee (Brit. Med. Jour., Sept. 28, '89).

General Therapeutics of Mercury.

Metallic Mercury.—Mercury itself is used in the following forms:—

Blue Mass.—The mercury is triturated with the excipients until the mercurial globules are no longer visible under a microscope magnifying 10 diameters. The mass thus prepared contains 33 per cent. of mercury. The dose is from 1 to 10 grains. The familiar "blue pill" should contain 3 grains, but this dose is sometimes exceeded.

Gray Powder.—Mercury with chalk, or hydrargyrum cum creta, is likewise a fine triturate, but it contains 38 per cent. of mercury and 57 per cent. of prepared chalk. Each grain of gray powder contains about $\frac{1}{3}$ grain of mercury. The dose in children is from $\frac{1}{2}$ to 2 grains.

Mercurial or blue ointment is prepared by triturating mercury with lard and suet until the mercurial globules are invisible as above. It contains about 50 per cent. of metallic mercury.

Mercurial plaster is a combination of metallic mercury, oleate of mercury (see OXIDES), and lead plaster.

THERAPEUTICS.—Metallic mercury is

mainly employed as a cathartic in the form of blue pill. As such it is an excellent agent when hepatic torpor is present, though it sometimes proves irritating to the intestinal tract. Nine grains, or three 3-grain pills, usually give rise to little, if any, griping. If this symptom is feared, however, a little opium may be added. It is customary to administer a saline purgative the next day to enhance the effect produced.

Case of heart-failure of a year's standing, with increasing severity of symptoms, in which the administration of blue mass produced the most excellent results after other treatment had failed. The drug was combined with digitalis and sulphate of cinchonidine in the same proportion, 1 grain of each in every pill. Three pills were taken daily. Excellent results obtained with the same combination in cases of general œdema, as a result of weak heart simply or of organically diseased heart. Regulated diet and hygiene should accompany the use of the remedies. William Pepper (Univ. Med. Mag., Jan., '90).

Mercuriol belongs to a class of preparations in which the metals are united with nucleinic acid. The writer has employed this preparation during the past two years in many hundreds of cases. He has used it as an external application in the form of a powder, occasionally pure, but in such cases has found that it caused smarting. If it is mixed with boric acid or chloretone the application is painless. The powder is markedly stimulating, and is useful in tubercular conditions and fungoid granulations. Mercuriol is useful in chronic ulcers when employed in the form of a salve containing from two to five per cent. In gonorrhœa it can be employed as an injection in 0.5 to 2 per cent.; in syphilis it can be given internally in doses as high as 0.1 gramme. H. Greesmann (Münch. med. Wochen., Feb. 3, 1903).

Gray powder, or mercury with chalk, possesses much the same properties as blue mass, but it acts more mildly and

is, therefore, considerably used in the treatment of children suffering from hepatic atony and the intestinal ailments resulting therefrom. The antacid power of the chalk adds to its value in the treatment of infantile diarrhoea with watery, colorless stools. It is also used in infantile syphilis with marked success, especially in syphilitic marasmus.

Mercurial ointment, besides its well-known value in the treatment of syphilis (*q. v.*), is also employed as an antiphlogistic and resolvent in inflammatory disorders of the joints. It is especially valuable when effusions and ankylosis are feared as a result of the local changes. Its antiphlogistic properties also manifest themselves in inflammatory processes of the peritoneum, and it is often used in peritonitis. The same may be said of orchitis and epididymitis, glanders, and other surgical mycoses.

Neapolitan ointment successfully used in treatment of malignant pustule. The ulcer was daily washed with sublimate, carefully wiped with cotton soaked in the same solution, in order to remove all the mortified portions, and covered with a piece of linen upon which the ointment had been spread. This dressing was removed only during the time required to wash the ulcer. Definite recovery took place within four or five weeks. N. Vertepoff (*Medit. Oboz.*, No. 5, '94).

A substitute for inunction in mercurial treatment, namely: impregnating the garments of patients needing mercurial treatment with some preparation of the metal, as suggested by Merget. Welander used a powder consisting of 40 per cent. of mercury, with zinc and aluminium in amalgam. Personal modification of this method used the last two years with good results. A coarsely woven cloth, "mercolint" (made by the firm of Beirsdorf, in Hamburg), is impregnated with a salve containing 90 per cent. of mercury. Shirts made of mercolint are worn by the patients night and day. When in about four weeks the gray color of the garment changes to

white, it is concluded that all the mercury has been absorbed: *i.e.*, 2½ drachms to 12½ drachms. Mercury appears in the urine and stomatitis, with salivation, is produced. Blaschko (*Berliner klin. Woch.*, Nov. 13, '99).

It is considerably used in the treatment of pediculi, or other parasites of the hairy regions of the body; but, as shown by Leidy, any fixed or volatile oil or even a bland ointment will act as effectually. Hence mercurial ointment should only be employed after trying the less dangerous preparations. If the former is used, care should be taken to avoid salivation.

When turpentine is placed in a bottle with mercury and shaken, the metal will separate into the finest particles. This facilitates the preparation of salves, etc. M. R. Loza (*Gaceta Medica*, May 15, 1900).

Mercurial plaster may be used in the same disorders as the ointment and with the same objects in view. It is especially valuable in the treatment of splenic enlargements of malarial origin. It is also used to prevent pitting in small-pox.

Nitrates of Mercury.—The nitrate or pernitrate of mercury is only used in the preparation of a solution and an ointment.

Solution of acid nitrate of mercury, the liquor hydrargyri nitratis, contains about 60 per cent. of nitrate of mercury and 11 per cent. of free nitric acid. It is used as a caustic.

Ointment of nitrate of mercury, the unguentum hydrargyri nitratis, or citrine ointment, contains about 7 parts of mercury, 18 parts of nitric acid, and 75 parts of lard-oil. It is not a stable preparation and should be freshly prepared.

THERAPEUTICS.—The solution of acid nitrate of mercury is a very active caustic, instantly penetrating the superficial tissues and especially phagedænic ulcerations. When, therefore, it is to be ap-

plied, the spot to be touched should be surrounded by a protective covering of vaselin, and a glass rod used for the application to precisely limit the amount employed. Any surplus should be washed off. It is extensively used for the destruction of syphilitic sores, benign and malignant neoplasms, lupus, epithelioma, noma, nævi, moles, warts, etc.

Acid nitrate of mercury has been employed with success in the local treatment of nearly all unhealthy-looking sores. The preparation of the British Pharmacopœia, which is a syrupy fluid, is used. The acid should be applied with a brush, and care should be taken not to use too much of the drug, this being easily prevented by means of blotting-paper. Large scars can thus be avoided, especially in cases of acne of the nose. For large ulcers, patches of lupus, and for the tubercles and patches of syphilitic lupus, the acid can be applied more freely; and in these cases it must be left to act upon the part for two or three minutes before the blotting-paper is used. Caution should likewise be exercised with the drug, as indicated, when it is to be applied to the mouth, tongue, cheek, or throat. Hutchinson (Archives of Surg., Oct., '91).

Case of lupus vulgaris successfully treated by acid nitrate of mercury. The patient had suffered from lupus vulgaris of the nose for more than four years, and had undergone many scrapings. Acid nitrate of mercury, pure, had been applied on six occasions under cocaine anæsthesia, with the result that the parts had healed over soundly, no trace of lupous tissue being now visible. Sheild (Brit. Jour. of Dermat., Feb., '96).

The ointment of nitrate of mercury, citrine ointment, may be advantageously employed for deep-seated inflammations limited to restricted areas, when the superficial tissues are intact. It may thus be used to abort boils and felons.

Ointment of the nitrate of mercury successfully used as an abortifacient of boils and felons. In treating felons the entire finger should be covered with the coating of the ointment about $\frac{1}{8}$ of an

inch thick, and then wrapped with a piece of thick adhesive plaster. The dressing should remain twenty-four hours, after which no further treatment is necessary. R. Kenner (Med. Rec., Nov. 10, '88).

When, however, the ointment of nitrate of mercury is to be used in ulcerative processes, for which it is employed as an active stimulant, it should be diluted by the addition of an equal quantity of lard. In this strength it is especially useful in chronic disorders of the scalp, and is occasionally used in chronic eczema, psoriasis, and other cutaneous disorders of the body, but only when localized. Its application over large surfaces is dangerous.

Cyanide of Mercury.—*Cyanide of mercury*, hydrargyrum cyanatum, occurs in whitish crystals devoid of odor, but of metallic, bitter taste. It is principally used as a local antiseptic in 1 to 10,000 solution. It is very poisonous. The dose is $\frac{1}{32}$ to $\frac{1}{16}$ grain.

THERAPEUTICS.—The oxycyanide of mercury has been highly lauded as an antiseptic in surgery. It is well tolerated by the tissues, and is thought to be specially applicable to suppurating surfaces or to mucous membranes, as the conjunctiva, to render them aseptic.

As a disinfectant, especially when metallic instruments are to be used, oxycyanide of mercury is considered the best substance, since it does not in any way affect the latter, not even the edge of cutting instruments. A 3-per-cent. solution corresponds to a 2-per-cent. solution of corrosive sublimate, but a 1 to 10,000 solution has been found efficacious for external uses. Monod and Malgaigne employed it successfully in hospital and private work and found that it possessed all the qualities of corrosive sublimate. It prevents the growth of cultures and kills developed cultures, including the

bacillus coli, the *bacillus pyocyaneus*, streptococci, etc. The drug being exceedingly toxic, they never use large quantities at a time and avoid using it for washing out cavities.

Oxycyanide of mercury in 5 per 1000 solution displays in laboratory experiments an antiseptic potency always equal to and often greater than that of 1 to 1000 sublimate solution. It has no disadvantages other than those possessed by corrosive sublimate, and it has the special advantage of not affecting either the hands or the instruments of the surgeon. C. Monod (*Le Prog. Méd.*, Oct. 26, '95).

The writer has made a number of experiments with different microorganisms in testing the value of mercuric cyanide as a surgical disinfectant. He comes to the conclusion that it is very unreliable, as, after more than ten minutes' immersion of threads of the various staphylococci in a solution of 1:1000, there were still viable germs. Even a strength of as much as 1:500 had no effect on these germs after exposure of one-half hour. His observations show that mercuric cyanide is a very uncertain surgical disinfectant, and bound to prove disappointing if relied upon to the exclusion of more efficient means of sterilization. C. Harrington (*Boston Med. & Surg. Jour.*, Jan. 14, 1904).

Cyanide of mercury, highly recommended as an antiseptic for use by oculists, is efficient, though non-irritating.

The micrococcus pyogenes aureus is present in apparently perfectly healthy conjunctival sacs. The operation for cataract can be performed successfully without troublesome complications. Oxycyanide of mercury is a powerful antiseptic. Fourteen patients were treated by means of irrigation with a solution of the drug in the proportion of 1 part to 1500 of water. On subsequently submitting the conjunctival mucus to systematic culture, the tubes only remained sterile in 20 per cent. of the cases. The other tubes contained various microbes, especially the pyogenes aureus. Further experiments proved that the eyes could only be rendered

thoroughly aseptic by eye-douches, repeated every few minutes for at least three days; the oxycyanide is superior to solutions of the bichloride, and is better borne by the conjunctiva. Chibret (*Recueil d'Ophtal.*, p. 294, '89).

Preparations of mercuric cyanide may usefully be prescribed in the form of fomentations and collyria. A formula which is of daily use in cases of progressive choroidal atrophies in myopes and in disseminated forms of choroiditis in gouty persons is as follows:—

R Hydrochlorate of cocaine, 3 ³/₄ grains.
Cyanide of mercury, 4 ¹/₂ grains.
Cherry-laurel water, 6 ¹/₄ drachms.
Distilled water, 8 ¹/₂ ounces.—M.

This same lotion may be used in certain forms of severe exudative and plastic choroiditis, as a subconjunctival injection. Galezowski (*Recueil d'Ophtal.*, No. 12, '96).

It has been recommended as a safe agent for hypodermic use, but is an extremely dangerous remedy for intravenous injections.

Injections of 1-per-cent. solution of oxycyanide of mercury employed in the treatment of syphilitic conditions. Injections are well borne, little painful, and, used in over 1000 cases, has never caused untoward effects. Six or eight injections are equivalent to an energetic treatment by means of frictions. Chibret (*La Sem. Méd.*, Apr., '90).

Internally it has been administered for syphilis and diphtheria, but in both of these diseases other remedial agents are to be preferred.

Oxides of Mercury.—YELLOW OXIDE.

—The yellow oxide of mercury, hydrargyri oxidum flavum, occurs as a yellow, fine, amorphous powder devoid of odor, but metallic to the taste. It is insoluble in water, and becomes darker on exposure to light. It is too irritating for internal administration and is mainly employed to prepare the

Ointment of yellow oxide of mercury
or unguentum hydrargyri oxidi flavi,

which contains 10 per cent. of the oxide. This is too strong for use in ophthalmic practice, however, and is usually reduced by the addition of lard, lanolin, etc.

Proper way of preparing the yellow-oxide-of-mercury ointment for use in ophthalmological practice. To the required amount of powder in impalpable form on a clean glass or porcelain slab, add a few drops of any bland non-irritating fixed oil, and mix well with a clean spatula; to this slowly add the necessary petrolatum. The following prescription in the hands of a competent pharmacist will be entirely satisfactory:—

℞ Olei ricini, 4 drops.

Hydrarg. oxidi flavi, 3 grains.

Misce et adde:—

Petrolati, 2 to 4 drachms.

The mass is so thoroughly homogeneous that not until it is kept for a long while will the mercury gravitate to the bottom.

T. E. Mitchell (Ophth. Rec., Feb., '98).

It is also used to prepare the *oleate of mercury*, or *oleatum hydrargyri*, which contains 2 per cent. of the yellow oxide and 8 per cent. of oleic acid. It is used in preference to blue ointment by many practitioners.

The *red oxide of mercury*, or *hydrargyri oxidum rubrum*, occurs in the form of orange-red crystals, which, though carefully pulverized, always contain irritating particles. It is insoluble in water, and is not used internally. It is employed to prepare an ointment, the

Ointment of red oxide of mercury, but this has been advantageously replaced by the ointment of the yellow oxide, owing to the finer grain of the powder obtained from the latter.

Black wash and yellow wash, two official preparations considerably used as stimulants, depend for their virtues upon the black and yellow oxides formed. Black wash contains 1 drachm of calomel to a pint of lime-water; while yellow wash contains $\frac{1}{2}$ drachm of corrosive sublimate to a pint of lime-water.

THERAPEUTICS.—The yellow oxide enjoys the confidence of ophthalmologists in the treatment of blepharitis and conjunctivitis, owing to its antiphlogistic and alterative properties. In the acute form of the latter disorder an ointment containing 3 to 4 grains of the yellow oxide to the ounce is sufficiently strong, while disorders of the lids usually require a preparation four times that strength. The ointment should not, however, be allowed to come into contact with the conjunctiva. Corneal opacities and ulcers are also favorably influenced by the continued application of an ointment of yellow oxide of mercury.

Corneal ulcer successfully treated by the simple application of a salve of the yellow oxide of mercury, followed by an occlusive dressing. Sicherer (Rev. Gén. d'Ophthal., Nov., '96).

In affections of the skin it has been used with advantage in eczema and acne. Erythematous pruritus of the anus is quickly arrested by its use.

Valuable ointment for anal pruritus is composed of 60 grains of red oxide of mercury with 450 of vaselin. Morain (Rev. Inter. de Méd., July, '95).

A very useful combination when much pustulation exists in acne is:—

℞ Ungt. hydrarg. oxid. rub., 3 drachms.

Ungt. sulphuris, 6 drachms.

Ungt. zinc. oxid., ad 2 ounces.—M.

G. T. Elliot (Post-graduate, Oct., '96).

The red oxide is mainly used to stimulate obstinate ulcerative processes, such as those occurring in venereal disorders. It is also employed in parasitic diseases of the skin.

Varicose ulcers of legs successfully treated with ointment of the red oxide of mercury. Official ointment too strong (1 part of the red oxide of mercury to 9 of vaselin); so that it was mixed with 1 to 2 parts of vaselin. Influence upon suppurating wounds was apparent in a short time. First day, patient complains of violent pains, which by the third have

entirely or nearly disappeared. Dressing should be renewed once a day and the salve be spread upon a piece of cloth to the thickness of a knife-blade; a flannel or small bandage may be used to wrap the extremity. Rest in bed will accelerate the healing process. H. Langes (Münch. med. Woch., No. 48, '94).

Black and yellow wash are also mainly employed to stimulate chancres and syphilitic ulcers, the yellow wash being far more potent than the black. The latter is sometimes used in eczema.

The oleate of mercury is often substituted for a much more cleanly agent, blue ointment. The irritating action of the red oxide should be borne in mind, however, and it should be rubbed into the tissues in somewhat smaller quantities and with less rapidity. It is also employed in parasitic skin disorders, having replaced gray ointment in many of these, especially tinea tonsurans, pediculi corporis, and sycosis.

Iodides of Mercury.—The red iodide or biniodide of mercury, or hydrargyri iodidum rubrum, is a scarlet-red powder having no odor or taste. It is practically insoluble in water, and slightly soluble in alcohol. The dose is from $\frac{1}{32}$ to $\frac{1}{8}$ grain, administered in pill form.

Albuminous solutions of the biniodide remain clear for days, whereas with the bichloride of mercury an insoluble precipitate is formed. The solution for use is to be made with the iodide of potash. A jar containing bichloride solution and blood showed, at the end of six weeks, a few bacilli and micrococci, and its surface was covered with penicillium glaucum, while a similar jar containing biniodide solution was perfectly free from any change. G. Sims Woodhead (Proc. Royal Soc. of Edinburgh, '89).

An albuminous precipitate is always produced by the biniodide of mercury. The tartaric-acid solution of the bichloride of mercury, as originally proposed by Laplace, is the only antiseptic preparation of mercury which will not act in this way. Hare (Univ. Med. Mag., Sept., '89).

The solution of arsenic and iodide of mercury, the liquor arsenici et hydrargyri iodidi, Donovan's solution, contains 1 per cent. each of the red iodide of mercury and iodide of arsenic in distilled water. The dose is from 3 to 10 drops, largely diluted.

The green or yellow iodide of mercury, or protiodide, the hydrargyri iodidum flavum, is a yellowish-green, amorphous powder, devoid of odor or taste. It is decomposed by light. The dose is from $\frac{1}{8}$ to $\frac{1}{4}$ grain.

THERAPEUTICS.—The red iodide of mercury is principally used in the treatment of syphilis (see SYPHILIS), but it has also been found useful in various other disorders and as an antiseptic in surgery, and in infectious disorders.

Sodic-iodide solution of mercury biniodide 1 to 2000 used for all amputation-flaps and recent wounds. Union is secured more firmly and rapidly than with carbolic-acid dressings. The firm and rapid union being attributed to the solution and removal of the two layers of effused fibrin, on the flat surfaces, by the fibrin-solvent sodic-iodide vehicle for the antiseptic agent. It has the advantage of being non-irritant, and it is rapidly eliminated by the kidneys. C. R. Illingworth (Satellite of the Annual, Jan., '92).

Biniodide of mercury dissolved in a solution of sodium iodide does not produce the unfavorable conditions that follow the use of the bichloride. Hanbury Frere (N. Y. Med. Jour., July 28, '94).

Hypodermic injections of biniodide of mercury are very effective in hereditary syphilis. Children tolerate large doses of strong solutions of the drug, and the writer recommends as an ordinary dose .06, at intervals of five to eight days, according to the severity of the specific manifestations. A perfect solution of the mercurial is obtained by adding a small quantity of potassium iodide, and for this purpose a few drops of the following solution is recommended: Potassium iodide, 1 gramme; distilled

water, 4 grammes. Subcutaneous injections produce very painful swellings which do not disappear for some time, and for this reason intramuscular injections are to be preferred. They are somewhat painful, but do not cause as much discomfort as the subcutaneous injections. Breton (*Revue Men. des Mal. de l'Enfance*, Dec., 1903).

In the infectious fevers biniodide of mercury has been found of value both as a local antiseptic and as a general germicide.

Scarlet fever abated in five instances by the internal and external use of the biniodide of mercury. The disease has been prevented from spreading by painting the throat with 1 in 500 solution every four hours. In the cases reported the following formula was used:—

R Hyd. bichlor., $\frac{1}{8}$ grain.
Potass. iod., 15 grains.
Sp. am. co., 1 drachm.
Syrup., $\frac{1}{2}$ ounce.
Aq., 6 ounces.

M. Sig.: Half an ounce every second hour.

This was used in a child 9 years old. For local application the solution varied from 1 in 2000 to 1 in 500, to be used in the form of a spray or by painting with a camel-hair brush. C. R. Illingworth (*Provincial Med. Jour.*, Jan. 1, '90).

Biniodide of mercury precipitating tyrotoxicon in liquids, it has been recommended as an antidote in ptomaine poisoning.

The green or yellow iodide is mainly employed in syphilis (*q. v.*).

The solution of arsenic and mercuric iodide is much esteemed in the treatment of chronic disorders of the skin: leprosy, lupus, etc. It is also advantageous in chronic gout and rheumatism as a general alterative and tonic.

Chlorides of Mercury.—The mild mercurous chloride, hydrargyri chloridum mite, calomel, is a tasteless, white, impalpable powder, insoluble in water and alcohol. Its dose varies from $\frac{1}{4}$ grain

to 10 grains or even much more, according to the disorder treated.

The bromides and the chlorides are powerless to convert calomel into corrosive sublimate; such a change occurs only on contact with the alkaline iodides. If it took place in the presence of chlorides, it could not be avoided by the patient simply abstaining from salted articles of food; it would be necessary to remove all the chlorides from the organism. Pouchet (*Stylus*, March, 1900; *Alienist and Neurol.*, Jan., 1901).

The mercuric chloride, hydrargyri chloridum corrosivum, or corrosive sublimate, is prepared by subliming the bisulphate of mercury with chloride of sodium. It occurs in the form of transparent, whitish crystals, of a metallic, acid taste, and is soluble in sixteen parts of cold and two parts of boiling water, and in three parts of alcohol. Its dose varies from $\frac{1}{100}$ to $\frac{1}{8}$ grain.

Sublimate solutions should be kept in brownish-yellow bottles, in order to prevent the decomposition which ordinary light gradually produces. H. Michaelis (*Zeits. für Hyg.*, Aug. 23, '88).

Bichloride undergoes chemical change when in contact with organic matter, and is immediately converted by albumin into an insoluble albuminate. A small quantity is soluble in excess of albumin, but is likely to be at once decomposed, in masses of excreta, into the insoluble sulphide by the sulphuretted hydrogen present. W. B. Hills (*Boston Med. and Surg. Jour.*, Feb. 21, '89).

Ordinary water causes an immediate decomposition of bichloride of mercury; this decomposition steadily continues under the influence of air and light. This decomposition ceases or becomes arrested when the air and light are excluded. Solutions of bichloride of mercury made in distilled water undergo only trifling decompositions, even when exposed to air and light. Bureker (*Archives de Méd. et de Pharm. Milit.*, Apr., '95).

THERAPEUTICS OF CALOMEL.—As a purgative, calomel is still considerably

employed, though slow in action and occasionally unreliable. The possibility of retention under such circumstances renders mercurial absorption possible when a large dose is administered, and it is always prudent to administer a saline the next morning or to give another purgative at the same time—a poor recommendation for the primary drug. The compound cathartic pill is based upon this principle. Recent labors have severely shaken the general belief that calomel increases the flow of bile, and tend to confirm the view that as a true purgative there are many agents, especially podophyllin, that are preferable. Its germicidal action may render it useful, however, in the presence of infectious processes. In diphtheria, for instance, it is useful and it will sometimes check the disease when administered, but this can hardly be credited to its merits as a purgative.

Effect of calomel on the secretion of bile as the result of experimental research on dogs with biliary fistulas. Oil has a negative effect on the secretion of bile, calomel a decided inhibitory effect, and salicylate of sodium, while it increases the quantity of bile secreted, lowers the density: the salts, etc., are reduced below the normal amount. The only active cholagogue is bile itself, the ingestion of which is always followed by a considerable hypersecretion of bile. Boyon and Dufour (*Presse Méd.*, Oct. 13, '97).

The writer states that calomel is very inconstant in its action as a poison. Guy states that six grains have proved fatal, while an ounce has been taken with impunity. Rungberg records a case in which three injections of one and a half grains each, given within a month, proved fatal, and mentions other similar fatal cases after subcutaneous injections of small doses. The author appears to favor the theory, rejected by Guy, that calomel acts as a poison only by its partial conversion into perchloride of mercury by the free hydrochloric acid of the gastric juice. On this

supposition the very small fatal doses could be explained on the theory that hyperacidity of the gastric juice converts the calomel into perchloride more rapidly than usual, though he deems it more likely that an impurity (probably perchloride of mercury) was originally present in the fatal cases. On the theory that it acts only by conversion into perchloride of mercury the relative impunity of large doses is explained by the supposition that so soon as sufficient conversion has taken place, purgation supervenes and the remainder of the calomel is expelled unchanged. Calomel injected subcutaneously according to the theory would be converted into perchloride by the chlorides of the blood, but in this case the action of a small quantity could not cause expulsion of the remainder, hence the fatal results from small subcutaneous doses. Though appearing to have some faith in the perchloride theory, the author, however, states that little is to be feared when pure calomel is used in moderation, however the method of administration. T. L. Bunting (*Lancet*, Nov. 26, 1904).

Purgative effects are obtained with more certainty and with no danger of ptyalism when very small doses, $\frac{1}{8}$ to $\frac{1}{2}$ grain, are administered every half-hour until 3 grains are taken. All the mercury thus ingested undergoes transformation into the purgative salt in the intestinal tract, and there is no surplus to awaken toxic symptoms later on.

Large doses of calomel have been recommended in the early stages of acute febrile diseases, pleurisy, pneumonia, yellow fever, and even in such affections as cholera. More clinical experience is necessary to confirm this view, but it seems to be in accord with data upon the physiological action of the remedy.

The same indications apply to the use of calomel in jaundice, or biliousness due to exposure to cold, the action being probably derivative and germicidal, to say nothing of stimulating powers which

minute doses of mercury are known to possess.

In children very small doses thus become extremely valuable when general inaptitude is associated with "heavy" breath and usually ill-smelling stools. Four doses of $\frac{1}{25}$ grain every half-hour until five doses are taken, repeated in four or five days if needed, sometimes changes the entire aspect of the child. It is best administered thoroughly mixed with a little sugar, the powder being merely placed on the tongue. The tonic action of the remedy plays an important rôle here—provided only minute doses are adhered to.

In infantile diarrhoea this treatment is invaluable, but $\frac{1}{20}$ grain should be administered every three hours. As an anthelmintic it may also be used with considerable advantage.

Diphtheria.—In this disease calomel may be employed advantageously in three ways. As a preventive it has been highly recommended by Daly, of Pittsburgh. It is to be administered in small doses until its action upon the intestinal tract is shown by characteristic stools.

Fumigations are also valuable, the calomel being volatilized under a tent formed by sheets arranged over a frame inclosing the bed. It tends to soften the soft membrane to facilitate its detachment, while acting as a germicide.

Diphtheria treated by mercurial fumigations. For a child of 8 to 10 years 40 to 60 grains of calomel are volatilized under a suitable tent or canopy, this being kept over the child 20 minutes. This procedure is repeated every 2 to 3 hours during the first day. The process is continued at the rate of 2 to 3 times a day for a week if the cough tightens again. The lamp should be powerful enough to volatilize rapidly, so that the temperature under the canopy may not be unpleasantly elevated. J. Corbin (N. Y. Med. Jour., vol. xlvii, p. 261, '88).

Calomel fumigations of value in croup.

The indications of this treatment are recession of the suprasternal notch during inspiration, with retraction of the infrathoracic walls, stridulous breathing, hoarseness or aphonia at times, and lividity of the surface resulting from the deficient oxygenation of the blood. The amount of the mercurial salt to be vaporized varies from 5 to 20 grains, repeated at intervals varying from one-half to two or three hours, according to the severity of the symptoms—in the average case 15 grains hourly. The patient is to be kept in the vapor-saturated atmosphere, within a tent, for a period varying from ten minutes to half an hour. Fruitnight (Arch. of Ped., June, '95).

All the mercurial preparations possess diuretic properties, but these are especially marked when calomel is employed. The increase of urine may range from a few ounces to as much as 370 ounces (Jendrassik). When administered in moderate doses repeated every three or four hours, the diuretic action appears early in some cases and only after four or five days in others. According to Lipari, tolerance for calomel is greatest in those cases in which diuretic action is most rapidly produced. On the contrary, the tolerance is least in those instances where the production of diuresis is retarded. The main untoward feature of its use is the marked tendency to cause ptyalism and other manifestations of mercurial intoxication. Hence the patients should be carefully watched. Calomel is especially efficacious in dropsical conditions of cardiac origin.

Six doses of $1\frac{1}{2}$ grains each may be given during the day, one every three hours. In cases in which there is a comparatively small cardiac lesion with marked dyspnoea and hypertrophy or dilatation, with albuminuria, oedema, and ascites, this treatment is useful. After the first few doses have been given, as a rule, an increase in diuresis is established, and on the second or third day

quite copious evacuations of the bowels take place. There is marked improvement in all the symptoms, cardiac and otherwise. Even when the calomel is no longer administered these good results persist for from twenty-four to forty-eight hours. In order to prevent excessive salivation, or to relieve it when already produced, the following mouth-wash is used:—

℞ Chlorate of potas., 2 1/2 drachms.
Tannic acid, 4 grains.
Distilled water, 10 ounces.—M.

The calomel does good by relieving the congestion of the liver and the renal circulation, thus indirectly reducing the resistance to the heart produced by arterial pressure. At the same time an absolute milk diet is ordered. Of 107 cases of grave cardiac disorder with distressing symptoms of failure of the heart, treated in this manner by Moraldescu there were 14 deaths: 2 died of pneumonia after the heart-symptoms were relieved; 3 died before the treatment had sufficient opportunity to be tried; the remaining 9 were of advanced years and the disease was also far advanced.

Mercury is especially of value when there is no concomitant renal or hepatic disorder, and hurtful, according to Huchard, when the urine contains albumin.

The best results from mercury are seen in œdema resulting from cardiac failure. Diseases of the kidneys limit or entirely abolish the diuretic action. It is important that full doses be given, as small amounts are not diuretic. For the first two days the secretion of urine is diminished, but afterward it is augmented. Action of the drug is due to the irritation which it produces while passing through the kidneys. W. Bieganski (*Archiv f. klin. Med.*, Sept., '88).

Calomel is useless in cardiac diseases complicated with cirrhosis, and hurtful in renal or heart disease if albumin be

present in the urine. H. Huchard (*Revue Gén. de Clin. et de Thér.*, Apr. 25, '89).

Continuance of the treatment during diuresis will not alter or increase the effect. Its action is most marked in dropsies due to heart disease. Its action in dropsies of hepatic origin is not to be relied upon. Pathological changes in the kidney prevent or abridge its action. Small doses will prove of no avail. The diuretic action may, in all probability, be ascribed to the irritating effect which the mercury, during its elimination, exercises upon the renal epithelium. G. A. Fackler (*Jour. Amer. Med. Assoc.*, Aug. 16, '90).

In a desperate case of mitral regurgitation, accompanied with great dyspnoea, œdema, constant gastric pain, and scanty urine, digitalis had signally failed to give relief. Excellent results were obtained from the use of calomel in 10-grain doses at a time, administered on alternate nights. All the distressing symptoms disappeared gradually, and in fifteen days the patient was in comparatively good health. William Carter (*Liverpool Medico-Chir. Jour.*, Jan., '91).

Calomel is an excellent diuretic, and is especially useful in cardiac dropsy. The action is greater in the absence of renal complications. Dosage must be guarded (maximum 1 7/8 grains every two hours) and first symptoms of mercurial poisoning closely noted. In case of a weak heart, a combination of calomel and digitalis recommended. Finkelstein (*Inter. klin. Rund.*, July 25, '95).

Calomel is the best cardiac diuretic, if given in suitable doses and for a sufficient length of time. It may be given in severe cases of dropsy due not only to valvular disease, but also to cardiac failure from fatty degeneration, atheroma, and myocarditis. In fatty heart it is a specific, as it not only causes profuse diuresis, but causes the absorption of fat. When using calomel as a diuretic it should be given for six to eight days in about 1-grain doses five times in twenty-four hours, at intervals of three to four hours. Profuse diuresis sets in, as a rule, on the fifth day. When this occurs, calomel should not be abandoned, but continued till dropsy quite disappears. On the sixth or

seventh day, when diuresis is fully established infusion of digitalis may be prescribed with additional benefit. If the dropsy has not disappeared after the first course (eight days) the treatment may be repeated after a pause of eight days. Thirst may be allayed by sucking pieces of ice. Large consumption of fluids should be avoided. Mild stomatitis, gingivitis, colic, bloody stools, hoarseness, etc., need not interrupt the calomel treatment. Should, however, diarrhoea be severe, the dose may be reduced to three or four powders a day. Arbold Landau (*Wiener med. Presse*, No. 29, '97).

Calomel has also been used as a diuretic in renal hepatic disorders, but the clinical reports have been contradictory. Its behavior in the treatment of cardiac disorders would tend to demonstrate that renal lesions inhibit diuresis; hence it is doubtful whether it can even be prescribed with safety.

In seven out of fourteen cases of well-defined Bright's disease, accompanied with oedema, calomel was found superior to all other diuretics. Sklidowski (*Deutsches Arch. f. klin. Med.*, B. 52, H. 3, 4, '94).

In ascitic hepatic disorders, especially cirrhosis, the results reported seem to warrant a further trial of calomel as a diuretic. As small doses are recommended, it can safely be administered.

In those cases of biliary affections, as calculi and catarrhal icterus, and even in hypertrophic cirrhosis of the liver, in which the usual treatment fails, the use of calomel recommended. It must be given in doses of 1 grain every hour for five consecutive hours, and the same dose continued every two hours until the pain disappears and the temperature returns to normal. Zakharine (*Medycyna*, No. 1, '91).

Excellent results obtained from calomel in a case of hypertrophic cirrhosis in a man of 30 years. During the first month 1 grain was given six times a day (every two hours), every three days of treatment being followed by three days of

repose. The second month, four doses per day were given for three days, and again followed by three days of repose. The pain ceased, icterus disappeared, and there was a notable diminution in the size of the hypertrophied liver and spleen. Iodide of potassium entirely failed in this case. L. Sior (*Berliner klin. Woch.*, No. 52, '92).

In gall-stones and diseases of the biliary passages calomel acts not by increasing the biliary excretion, but by its disinfecting properties, thus diminishing the abnormal irritation of the mucous membrane of the gall-bladder. V. Schultz (*Berliner klin. Woch.*, No. 6, '94).

Calomel has recently been used with advantage in lupus. It was given hypodermically in small doses.

Fourteen out of twenty-five cases of tubercular lupus in which calomel treatment has been tried, all the injections have been made with $\frac{3}{4}$ grain in the buttocks; at first, on the average, about ten in ten days; then longer intervals were necessary, owing to pain, induration, etc. The action of calomel upon true tubercular lupus is certain and indisputable. Improvement is most marked after first injections. This treatment appears to be of use in old ulcerated tubercular lupus, tumescent, with profound infiltration. The more superficial forms and lupus erythematosus are less affected. Asselbergs (*Ann. de Derm. et de Syph.*, Jan., '98).

LOCAL USES. — Calomel was at one time considerably used locally as a stimulant in chronic inflammatory and ulcerative processes of the skin and mucous membranes, particularly in chronic eczema, herpes and syphilitic eruptions, and phlyctenular conjunctivitis, atrophic rhinitis, syphilitic laryngitis, etc. Since, however, its toxic effects have been better understood, the indiscriminate use of calomel thus involved has greatly decreased. When used in phlyctenular conjunctivitis, iodide of potassium should not be used simultaneously, an irritating compound being formed with what por-

tion of the iodide is eliminated with the lacrymal secretion.

THERAPEUTICS OF CORROSIVE SUBLIMATE.—Aside from its uses as an anti-septic (see **WOUNDS**, volume vi) and in syphilis (see article on **SYPHILIS**), the useful applications of corrosive sublimate are very similar to those of calomel, but, of course, in doses commensurate with its greater strength. Here, again, the activity of mercury as a tonic becomes manifest, provided very small doses are adhered to.

There are numerous possibilities of danger from irritation, etc., in the use of mercury and iodine preparations together. Injections of salicylate of mercury, thymol-acetate of mercury, and oleum cinereum, are not influenced by the coincident presence of potassium iodide in the tissues. Hence, he recommends the salts mentioned in using mercury with iodine. F. Lesser (*Deutsche med. Wochens.*, Nov. 28, 1901).

In the summer diarrhœa of children and adults very small doses are especially effective, $\frac{1}{100}$ -grain doses being repeated every hour or two. It stimulates the intestinal tract and acts as a germicide, thus arresting putrefaction, and rids it of its contents by gentle catharsis. It has also been found valuable in dysentery, administered in somewhat large doses. Corrosive sublimate has also been used with advantage by rectal injections in the latter disease.

For the treatment of dysentery, enemata of bichloride of mercury successfully employed in cases where ipecacuanha had failed, and where the patients complained from the beginning of nausea and vomiting. Two hundred and two patients were treated by calomel by the mouth and enemata of bichloride of mercury. To those who had no gastric intolerance calomel was given in minute doses at first. For others the enemata of the mercuric salt were as follow: Of a solution of the corrosive sublimate, 1 part to 5000, three enemata of 6 $\frac{1}{4}$ ounces

each were employed per day at first. Later on, only one enema of 3 to 1000 parts was administered during the day. The enemata should be given lukewarm, and for some patients a few drops of laudanum may be added to the injections. Lemoine (*Amer. Practitioner and News*, Mar. 29, '90).

Bichloride of mercury successfully employed in dysentery. Solution of 1 in 6000, or $\frac{1}{2}$ grain to 6 ounces of water, was given by rectal injection. Of seventy-five cases recently treated there were but three deaths, all the others being completely cured. Roudneff (*Medit. Oboz.*, No. 20, '93).

Mercuric bichloride has been found efficacious in the active manifestations of gonorrhœa, especially in women, and in gonorrhœal rheumatism.

Subcutaneous injections of the bichloride of mercury highly recommended for the treatment of gonorrhœal rheumatism. Jullien (*La Sem. Méd.*, May 16, '91).

For gonorrhœal vulvitis every part should be painted every day thoroughly with a solution of silver nitrate (20 grains to the ounce). In cases with tender mucosæ, as in blonds and very young women, every other day is sufficient. To prevent extension the vagina is to be packed with iodoform gauze, previously wrung out in 1 to 5000 bichloride solution, and this must be renewed once in three days. The vulva should be bathed every four hours in a lysol solution. Pryor (*Amer. Gyn. and Obst. Jour.*, Sept., '95).

Treatment of rectal gonorrhœa in women consists in irrigation of the rectum twice daily, through a speculum, with a 3-per-cent. solution of boric acid, followed by mercuric chloride, 1 to 8000, half a litre of each being used. The erosions are touched with argentamine, 2 per-cent. solution. Baer (*Deut. med. Woch.*, No. 8, '96).

It has also been highly recommended for the treatment of diphtheria, $\frac{1}{100}$ grain being given every three hours; but antitoxin is a much more effective agent and should be given the preference.

On the whole, the internal administration of bichloride in other than syphilitic affections has not received much support from the profession, owing to the fear of causing salivation and other manifestations of mercurial poisoning. Calomel has usually been employed, though, in truth, this agent is more liable to give rise to toxic symptoms than the bichloride.

Good results from mercury in 9 cases of cerebro-spinal meningitis occurring in an epidemic of grip. Only 1 case proved fatal. The dose varied from $\frac{1}{13}$ to $\frac{1}{7}$ grain of the bichloride according to the age of the patient, administered hypodermically once in twenty-four hours in the beginning and later once in forty-eight hours. Consalvi (La Sem. Méd., Jan. 15, '96).

Three cases of severe anæmia in which injections of mercuric chloride and quinine were used with good results. De Francesco (Gaz. degli Osped., Feb. 4, '96).

Case of pernicious anæmia in which mercuric-chloride injections were used, $\frac{1}{4}$ grain being administered daily for two months. Under this treatment the anæmia disappeared and the patient improved in every way. Patera (Riforma Med., May 28, '96).

Uniform success with mercury in cerebro-spinal meningitis; $\frac{1}{4}$ grain of mercuric chloride hypodermically at first and then $\frac{1}{16}$ grain every hour until there are symptoms of gastro-intestinal irritation. Smith (Jour. Amer. Med. Assoc., June 13, '96).

Local Uses.—The external uses of bichloride of mercury, besides its application to the operative field, are very numerous.

Surgical Mycoses.—In the treatment of furunculosis or boils, it is extremely valuable and often succeeds in arresting them when used early. Compresses of a 1 to 500 solution applied over the spot—or, when the furuncle shows its first signs on an extremity, baths of this strength—are very valuable. The threat-

ened region should be kept moist with the solutions, however.

As infection takes place from the outside, the following treatment is successful: The entire skin is cleansed by a warm bath with soft soap. The furuncle and the surrounding skin are washed with a 1 to 1000 solution of mercuric chloride. The boil is then covered with phenol and mercury plaster-mull, and the patient puts on clean linen. Twice a day new plasters are applied, and if the furuncle has opened the pus is gently squeezed out and the entire region carefully disinfected with the mercuric solution. Van Hoorn (Monats. f. prakt., B. 19, No. 1).

In onychia maligna, malignant pustule, and anthrax these applications are also of great value. The effect is enhanced by using warm solutions. It is also used with advantage in many skin disorders, including those attending infectious fevers. In small-pox it is quite effective in the prevention of pitting.

New way to use mercury, especially the corrosive sublimate, for preventing the pitting of small-pox: A solution of the salt is to be supplied by means of an atomizer in the following manner: For the first or second day of the eruption, the face is to be washed with soap and water, rinsed with borated water, and wiped dry with absorbent cotton before using the atomizer. After the third day the washing is unnecessary; the eyes are now protected with borated wadding, and the solution applied with the atomizer. In this way the skin is given a frosty appearance, and the danger of blistering by too copious a dose is avoided. The spray is to be applied chiefly to incipient pustules. Fifteen minutes after this operation of atomizing, which should not last more than a minute, the face is to be rubbed with a pledget of wadding dipped in a glycerin solution of sublimate of the strength of $\frac{1}{2}$ drachm to the ounce, the operation to be repeated three or four times during the twenty-four hours in the first three days, twice until the sixth or seventh day, when the spray may be suspended

and the glycerin painting continued until the scabs begin to drop off. Results were highly successful except in cases of confluent small-pox; salivation never occurred.

The spray-solution is made up as follows:—

℞ Corrosive sublimate, 15 grains.
Citric acid, 15 grains.
Alcohol, 90°, 75 minims.
Ether, q. s. to make 12½ ounces.
—M.

This solution contains 2 per cent. by volume of sublimate. Talamon (Ther. Gaz., May, '90).

The bichloride of mercury is employed locally in many diseases, and is introduced under each general heading.

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METHYL-BLUE.—Methyl-violet or methyl-blue, an aniline dye introduced as an antiseptic by Stilling under the name of *pyoktanin*, is thought to be a mixture of methyl-parasanilins in various proportions. It occurs in the form of pasty, bluish-violet, odorless crystals.

Preparations and Doses.—It may be used powdered, but greatly diluted with talc or some other inert substance (0.1 to 2 per cent.), and may be molded into pencils. It is most usually employed in solution from 1-100 to 1-2000.

Physiological Action.—The germicidal properties of methyl-blue have been defended by Fessler and Trojé, but the conflicting views of these authors have tended to impair the value of their experiments. According to Fessler, pyogenic organisms were killed by exposure to a 1 to 1000 solution during 15 minutes; Trojé found that at least 12 hours were required. These discrepancies were sustained by clinical experience, various observers obtaining conflicting results in surgical and especially ophthalmic work.

The cause of this was explained by Liebreich, when he showed that the composition of methyl-blue was uncertain. Indeed it may either be a tetra-, a penta-, or a hexa-methyl-parasanilin, or a mixture varying in proportions.

Therapeutics.—Though the results have been contradictory, there is much evidence in favor of the value of methyl-blue as an antiseptic in the treatment of suppurating wounds, and chronic disorders of the mucous surfaces. In conjunctivitis, ulcers of the cornea, trachoma, and corneal opacities it has been found of marked benefit by some observers and valueless by others. The cause of this, perhaps, lies in the fact that a solution of methyl-blue is unstable. Stilling especially recommends that a solution should be filtered, kept in dark bottles, and renewed every eight days.

In ophthalmia of all forms pyoktanin checks the discharge promptly, and prevents corneal ulceration. A solution of 3 grains to the fluidounce is quite strong enough, and should be applied every six hours in bad cases, after the conjunctival surface has been thoroughly cleansed. In follicular tonsillitis its action is prompt and uniform. The whole tonsillar surface and adjacent tissues should be mopped with the above solution two or three times in twenty-four hours, followed by a gargle of potassium bromide, 4 drachms; glycerin, 2 fluidounces; and water, 1 pint. This should be used every hour, and is better if used very hot. M. F. Coomes (Amer. Pract., xxix, p. 194, '99).

MALIGNANT TUMORS.—Good results have been obtained with methyl-blue in the treatment of epithelioma. It may either be injected, as in the case of superficial neoplasms, when a 10-per-cent. solution is to be used, or given internally in doses varying with the strength of the patient. It must be borne in mind, however, that under all circumstances re-

moval with the knife is preferable, and that methyl-blue should only be employed in inoperable cases.

In a patient suffering from villous cancer of the gall-bladder a pencil was introduced into the examination-wound every two days, and $9\frac{1}{4}$ grains in pills given. This treatment, begun March 6th, was followed by complete cure, at the time of report, May 6th. Mosetig-Moorhof (Univ. Med. Jour., July, '94).

Methyl-blue tried in the treatment of internal neoplasms of a malignant nature. It was given three times a day in doses of 1 grain, in pill form, or associated with belladonna as a suppository: Pyoktanin, 1 grain; extract of belladonna, $\frac{1}{8}$ grain; cocoa-butter, 31 grains. In a case of pronounced cancer of the stomach an astonishing result was obtained: the patient increased in weight, the vomiting and eructations ceased, and his appetite reappeared. O. Maibaum (Medycyna, No. 43, '95).

Case of epithelioma of the chin cured by interstitial injections of a 10-per-cent. aqueous solution of methyl-blue. At first an injection of 25 minims was made every two days. Later the amount was decreased, and only one or two injections were made during a week. The entire period of treatment was six months. The tumor atrophied, and at the end of the period of treatment only a fibrous cicatrix remained. Eight months later there had been no recurrence. Dubarry (Rev. de Thér., Apr. 15, '97).

In some cases it is necessary to combine the effects of methyl-blue with those of other agents—especially chromic acid and the galvanocautery, these being utilized mainly to destroy the superficial *detritus*.

Series of cases of cancerous tumors of the face rapidly cured by daily applications of 1 to 20 methyl-blue. It is, however, much more efficacious and rapid in action if the affected area be first cauterized, either with chromic acid or with galvanocautery. In deep tumors it should be injected hypodermically; and, where a large surface has been destroyed by the growth, skin-grafts should be used between the fifteenth and twenty-

first days. Darier (La Sem. Méd., May 23, '94).

Case of a woman, 57 years old, suffering with epithelioma of the face. The scabby surface of the epithelioma occupied the entire right side of the chin from the hollow as far as the middle of the horizontal ramus of the maxilla; vertically, it extended beyond the fold of the lower lip, and beyond the body of the maxilla. The surrounding tissue was red, hard, and œdematous; and the lip was much thicker on the diseased side. The tumor was divided into four lobes, each one of which was covered with bloody scabs. When they were separated, a large quantity of bloody pus was discharged. The tumor was adherent to the periosteum of the maxilla. Operation was refused and interstitial injections of methyl-blue were tried, although without any hope of success. During the first applications, 30 grains of a 10-per-cent. solution in distilled water were injected. Each time the entire diseased surface was saturated, the needle being pushed as deep as possible, until it touched the periosteum, the liquid being thrown in all directions. This was repeated as often as it was necessary. The tumor and all the red tissue surrounding it became of a bluish color. Several times hæmorrhages were provoked, but they were not alarming or of long duration, and a slight compression rapidly arrested them.

After the first application the intense itching complained of disappeared. During the first three months an injection was given regularly every two days, the average quantity of liquid injected being 15 grains. After a month of this treatment the tumor noticeably diminished in size. After the third month it had diminished one-half; cicatrization occurred from the periphery toward the centre. As recovery approached, a more considerable resistance was felt; the tissues became more compact and denser. During the fourth and fifth months of the treatment only one or two injections a week were practiced; the quantity of liquid used was also diminished in proportion as recovery advanced, and during this stage not more than two or three divisions of a Pravaz syringe were filled for the injection. At no time did the patient

feel pain in the kidneys or experience trouble on micturition. Five months after the first injections treatment was stopped; eight months later there was a firm cicatrix on the spot where the epithelioma had been, which was crossed in all directions by fibrous bands, which were very resistant to the finger and adhered to the maxilla. Dubarry (Normandie Méd., Apr. 1, '97).

Case of inoperable cancer in which, as a local application, the remedy proved very beneficial. The hæmorrhage was greatly reduced — almost stopped — and the superficial ulceration healed to a great extent. A 3-per-cent. solution of methyl-blue in equal parts of alcohol and water was used, an application being made every other day, swabbing it over the entire diseased area. H. R. Coston (Ther. Gaz., Apr. 15, 1900).

METHYLENE-BLUE.—Methylene-blue is one of the aniline dyes, a diphenylamin compound resulting from the action of sulphide of hydrogen and chloride of iron upon a solution of dimethylparaphenylenediamin. It occurs as a fine powder resembling iron filings. A solution of methylene-blue cannot be distinguished from a solution of methyl-blue, or methyl-violet (*pyoktanin*), without great care, and toxic effects have been observed as a result of errors in prescribing the one drug for the other, the dose of pyoktanin being smaller.

Administration and Dose.—The dose of methylene-blue is 1 to 3 grains.

Three cases of poisoning by what was supposed to be methylene-blue. In one of these the patient took the first dose at 2 P.M., and at 5.30 P.M. he had a distressing attack of vomiting. Patient was advised to continue his medicine. Five days later the patient reported that he could not retain it, and that it caused much purging. An investigation was made and it was found that the chemist had gotten a fresh supply of aniline, and that the new stock he had purchased was Merck's methyl-blue (*pyoktanin*), and not methylene-blue. Methylene-blue is an entirely

different preparation from methyl-blue, or pyoktanin. Harrington (Canadian Pract., July, '97).

Test to distinguish methylene-blue from methyl-blue (*pyoktanin*). The meniscus on the surface of a solution of methylene-blue in a test-tube, or a thin film of such a solution, has a greenish instead of blue color, while that of methyl-blue is blue under all circumstances. Another test may be made by adding sodium hydroxide to the blue solution, when methyl-blue becomes of a purplish-red, resembling port-wine dregs, while methylene-blue turns a deep-violet color. A. C. Smith, U. S. M.-H. S., quoted by S. T. Armstrong (Foster's "Pract. Thera.").

The changes in tissues and organs of healthy animals under the influence of medicinal doses of methylene-blue prohibit its use in patients in the dose usually recommended and for the time during which it is usually administered, as evidenced by the vomiting, diarrhœa, and blue urine so frequently observed. M. P. Michailow (St. Petersburg med. Woch., No. 23, '99).

Physiological Action.—In guinea-pigs a toxic dose of methylene-blue is followed, according to Combemale, by marked increase of the reflexes and of respiratory movements, ending in muscular paralysis and death. At the necropsy there is found a chocolate discoloration of the blood, caused by a destructive action upon the red blood-corpuscles, flaccidity of the heart, pulmonary atelectasis, engorgement of the liver with blue discoloration of the biliary ducts, and of the gastric and intestinal mucous membrane. T. Lauder Brunton and S. Delépine subsequently observed that the drug sometimes caused a great accumulation of iron in the liver.

Ehrlich and Leppmann having expressed the view that the analgesic properties of methylene-blue depended upon an elective affinity for the cylinder-axis of the nerve-endings, Combemale argued that the freedom of pain was

mainly due to the altered condition of the blood noted. Still, all that can be affirmed is that the drug shows two main active properties: it is capable of acting as an irritant and it can produce sedation of the motor and sensory nerves.

Recent experiments on frogs and rabbits by Mikhaïloff have shown that the leucocytes did not fix the methylene-blue until within a short time before death, and then very rarely. Healthy protoplasm was not colored by methylene-blue. At the autopsy of the animals experimented upon for a period of three weeks there had been found in all the visceral cavities a liquid colored blue; all the organs were also colored; the blood was methæmoglobinized, and the result had been a loss of oxygen, which had caused degeneration of the parenchyma and had favored thrombosis.

Methylene-blue can be detected in the saliva forty minutes after its introduction by the mouth, and in one hour and fifteen minutes after its administration by the rectum. Lemanski and Main (*Le Bull. Méd.*, Jan. 29, '93).

Therapeutics. — RENAL DISORDERS.—Methylene-blue being eliminated by the urine, Achard and Castaigne recently conceived the idea of using this property to determine renal permeability when disease of the kidney is suspected. When the kidneys were normal methylene-blue proved to be eliminated rapidly, communicating to the urine a distinctive color; in diseased conditions, however, elimination was retarded. Considerable œdema did not hinder the absorption of the methylene-blue, and its consequent appearance in the urine. The authors were able to trace, by defective elimination, the progress of lesions, which were at the same time indicated by the increase in clinical symptoms.

A dose of $1\frac{1}{2}$ grains of methylene-blue colored the urine until the third day.

After a dose of $\frac{3}{4}$ grain the urine was still colored on the following day, and even to a slight degree on the day after. The dose being gradually lessened, it was found that after $\frac{1}{3}$ grain the urine was distinctly colored, and had not entirely regained its normal appearance the next day. Constantin Paul (*La Sem. Méd.*, Dec. 30, '91).

Fifty observations in which use of methylene-blue in the diagnosis of renal permeability was used.

In 22 the blue was eliminated in a normal fashion, and autopsies in 5 of these showed that the kidneys were sound notably in one case of phthisis, and another of pneumonia in which albuminuria was present during life. On 28 occasions the permeability of the blue was faulty, and in 13 of these alterations in the kidneys were discovered after death. The lesions found were suppurative pyelonephritis in 3, considerable renal atrophy in 1, infarcts in a solitary kidney in 1, and cystic kidneys in another, in whom albuminuria was absent during life.

In limited lesions of the kidney—tubercular, for instance—in which the rest of the organs was healthy, the permeability was normal.

In several permeability varied. Thus a phthisical patient in whom it had been normal, suddenly showed delay of elimination, while œdema, albuminuria, and hæmaturia made their appearance.

On the contrary, in acute affections permeability was defective only throughout the illness, and became normal on recovery.

Some cases seemed to show that excess of permeability was as much a sign of disease as insufficiency.

The methylene-blue is given by intramuscular injections of 1 cubic centimetre of a 1 to 20 solution.

In some cases the blue is slowly eliminated, but the urine from the first gives a green coloration when warmed with acetic acid.

This is due to a colorless chromogen insoluble in chloroform, which latter precipitates it from methylene-blue.

In nine patients there was no delay in elimination of either chromogen or blue.

In eight others elimination of both was delayed; these had symptoms of renal disease, and the diagnosis of renal disease was verified often on post-mortem examination.

Often in similar cases the chromogen was eliminated before the blue, thus showing that the former is more diffusible and passes more easily through diseased kidneys than the latter.

In 11 there was only delayed elimination of blue, while the chromogen passed within the first hour after administration.

There were many clinical symptoms of renal disease in these, and on two occasions post-mortem examinations revealed advanced degenerative changes in the renal epithelium.

Delayed elimination of the blue alone occurs in some cases of renal disease, but it is not yet possible to state that renal changes are the sole cause of this. It is important, however, to test for chromogen by heat and acetic acid in patients who eliminate blue slowly, as by comparing the rate at which both chromogen and blue are eliminated one may be able to arrive at useful aids to diagnosis. Achard and Castaigne (*La Sem. Méd.*, June 23, '97).

The usefulness of methylene-blue will be greatest as a means of testing the permeability of the kidney and in the treatment of the early stages of chronic Bright's disease, while it ought to be invaluable in those cases of renal inadequacy occurring as concomitants of acute infectious and contagious disease, where the probable selective effect of the drug upon the functional epithelium of the tubules and glomeruli, stimulating the excretory function, will prevent the accumulation of toxic material in the blood. H. A. Tomlinson (*Northwestern Lancet*, xviii, p. 61, '98).

Renal permeability to methylene-blue only refers to the drug itself, and has no other significance whatever. Nesti (*Annales des Mal. des Organes Genito-Urin.*, Jan., '99).

Methylene has been used with success in renal disorders of various types, including cases of interstitial nephritis.

Methylene-blue used in twelve cases of acute nephritis, $4\frac{1}{2}$ grains being given three times daily, every other day. The results were good. G. Leventhal (*Wratsch*, No. 22, '94).

Methylene-blue administered in a case of chyluria due to the *Filaria sanguinis hominis*. The effects of the drugs were decided and prompt. Austin Flint (*N. Y. Med. Jour.*, June 15, '95).

Methylene-blue is an excellent microbicide, it coagulates pus, it prevents fermentation, and it is an excellent analgesic when given internally. These properties determine its indications in various affections of the urinary system. G. Richard d'Aulnay (*Bull. Gén. de Thér.*, 8e liv., p. 352, '97).

Methylene-blue employed in 8 cases of albuminuria. In 5 of these there was rapid diminution; in 3 complete disappearance of the albumin. The diseases represented were subacute and interstitial nephritis, sometimes complicated with renal congestion. The doses employed varied from $\frac{1}{8}$ to $\frac{3}{4}$ grain per day. Lemoine (*Compt. Rend. de la Soc. de Biol.*, May 7, '97).

Methylene-blue is an analgesic, as is well known. Its property of staining axis-cylinders of nerves has suggested to Ehrlich that it might prove as analgesic in painful neuroses of which neuralgia is the main type. It was also found effective in reducing the pain of rheumatism and sciatica.

On account of the property of methylene-blue staining nerve-tissues, especially the axis-cylinder, this drug has been tried as an analgesic in the treatment of 25 cases of painful affections. It was used both hypodermically (15 grains to 1 drachm of a 2-per-cent. solution) and internally by capsules (dose, $\frac{1}{6}$ to 15 grains per day). In 15 minutes the urine was noticed to be light green, in 2 hours a bluish green, and in 4 hours a dark blue. The saliva and feces were also colored, but the conjunctiva, skin, and mucous membrane remained free from color. In 2 hours from the time of administration the pain usually began to be relieved. Ehrlich and Leppmann (*Wiener med. Presse*, June 22, '90).

Complete relief obtained in neuralgias of unknown cause, of neuritis of alcoholism, of ataxia in the second period, and of bone-pains of tubercular, syphilitic, and traumatic origin. Methylene-blue relieved, without destroying entirely, certain neuralgias, and the pains of sclerosis of the spinal cord and those of subacute articular rheumatism. Finally, the drug failed to act in the neuralgias of hysteria, in the lancinating pains of the cachectic period of tabes, and in those of acute articular rheumatism. The drug was usually given in doses of 3 grains a day. The untoward effects most commonly, although not frequently, observed were cephalalgia, nausea, and diarrhoea. Combemale (Bull. Gén. de Thér., Apr. 30, '91).

Methylene-blue used as an analgesic with great success in neuralgia, sciatica, and locomotor ataxia, $4\frac{1}{2}$ grains a day to be given. Lemoine (Le Bull. Méd., Apr. 21, '95).

Methylene-blue recommended in acute articular rheumatism. It has a favorable effect upon the local inflammatory process in the joints and upon the general condition of the patients. J. R. Philpots (Brit. Med. Jour., Mar. 27, '97).

Methylene-blue is particularly valuable in those forms of rheumatoid arthritis due to autointoxication from the intestinal tract. W. Armstrong (Brit. Med. Jour., Apr. 24, '97).

Methylene-blue is valuable in habitual headache and hemierania. It may be given in $1\frac{1}{2}$ -grain doses along with equal parts of powdered nutmeg, the object of the latter being to prevent irritation of the bladder. E. Thomson (St. Petersburger med. Woch., May 30, '98).

Methylene-blue tried as an analgesic in 27 cases of sciatica. In 6 cases the pains disappeared in five days, in 13 the sciatica persisted several weeks, but the pains were less frequent and the patients could sleep. No effect was observed in 8 cases. About 7 grains were given daily. Slight gastric disturbances were complained of; pain during micturition was easily avoided by adding a little nutmeg to each dose. The drug first causes a numbness, which gradually changes into analgesia. Hence the necessity of con-

tinuing the drug while any pain is felt. Klemperer (Méd. Mod., June 27, 1900).

MALARIAL FEVERS.—Guttman and Ehrlich, basing their opinion upon the fact that methylene also stains the hæmatozoön, were also led to consider this agent as of value in diseases in which the parasite was found. The remedy was also tried with apparent success by Thayer, of Baltimore, in doses averaging $1\frac{1}{2}$ grains five times a day. The only untoward effect produced, when given by itself, was that of strangury, but this was relieved by the ingestion of nutmeg. This unpleasant symptom did not appear if the nutmeg were given from the beginning.

Though effective, methylene-blue is very inferior to quinine or arsenic. In fact, Pilliet questions whether the good effects obtained from the use of the drug in malaria are not due to the arsenic contained in the arsenous methylene-blue, the most common form used; also whether the unpleasant effects sometimes observed may not have the same origin.

Methylene-blue used in thirty cases of intermittent fever uncontrolled by quinine, powdered nutmeg being employed to prevent unpleasant secondary effects. Attacks were not only arrested, but even prevented. Kasem-Beck (Wratsch, Nos. 23, 27, '93).

Methylene-blue is of use in quotidian intermittent fever. The dose used is 8 grains daily, in four portions. Its favorable action is due not to the fact that it exercises any direct influence upon the plasmodiæ, but that it modifies the constitution of the blood, thus making it unfavorable for the growth of micro-organisms. Dabrowski (Wratsch, No. 11, '93).

Methylene-blue tried in four cases of intermittent fever in children. The patients soon showed a dislike for the remedy, which was vomited. It can in no way replace quinine in malaria, though it may be tried where children absolutely refuse to take quinine. Baginsky (Archiv f. Kinderh., B. 17, H. 3, '94).

Methylene-blue used in malaria, 10 or 12 grains being given to adults about ten hours before the rise of temperature is expected. A combination of it with quinine was often found to act especially well, and it is useful in cases where quinine alone has proved of no avail. It is apt to cause cystitis. Immunity to the malarial poison seems to follow on its continued use. Cardamates (Ther. Gaz., July, '98).

GONORRHOEA.—In this disease it seems to have proved of value when used internally and locally.

Methylene-blue used in the treatment of blennorrhagia apparently with good results. The drug acts on the micro-organisms, diminishing their vitality and virulence. A similar action may be said to occur in the case of gonococci. E. Boinet and P. Trintignan (Marseille-méd., Sept. 1, '92).

Gonorrhœal vaginitis may be treated with the following solution:—

℞ Methylene-blue, 2½ drachms.
Alcohol, 3¾ drachms.
Potassium, 3 grains.
Water, 6¼ ounces.

Two or three tampons of cotton wet with this solution are introduced into the posterior vaginal fornix and retained for two days. The pus-secretion stops by the fourth day, and congestion disappears in about twenty days. D'Aulnay (La Sem. Méd., No. 53, '93).

Methylene-blue is given in gonorrhœa in doses of 3 grains three times a day, also 15 grains of potassium citrate three times a day. James Moore (Brit. Med. Jour., Jan. 16, '97).

Methylene-blue will cure gonorrhœa in from 4 to 7 days, being especially fatal to diplococci and to pyogenic bacteria. It is best given in gelatin capsules in 1-grain doses three or four times a day. After the fourth day the dose may be reduced to twice a day. Gastric symptoms may be avoided by using the following formula:—

℞ Methylene-blue (medicinal), 1 grain.
Oil of nutmeg, 1 drop.
Oil of sandal, 2 drops.

J. A. O'Neil (Med. Record, lvii, p. 498, 1900).

Methylene-blue has been tried in a large number of disorders, but in none except those mentioned has it shown itself of special value.

Methylene-blue tried in fourteen cases of cerebral excitement, including mania, paranoia with delirium, chronic alcoholism, and hystero-epilepsy, and found very satisfactory, when injected into the gluteal muscles, in doses of 1 to 1½ grains. Its quieting effects came on within a few hours, and continued from one to four days. It gave rise to no untoward effects. Bodoïn (Klinisch-therap. Woch., Nov. 21, '99).

Methylene-blue (medicinal) in concentrated solution, or powder, in the treatment of metritis is painless, non-caustic, and non-toxic. It quickly arrests metrorrhagia and menorrhagia and diminishes leucorrhœal discharges. It sometimes suppresses pain, especially in dysmenorrhœa accompanied by an alteration of the uterine mucosa. Chaleux, Vivie, and Kohler (Archivio de Ginecol., Ostet., y Pediat., Oct. 10, 1900).

METRITIS (SUBINVOLUTION OF THE UTERUS).—Since metritis and endometritis in the septic sense nearly always co-exist in the same case the reader is referred to the article on **ENDOMETRITIS**. Inflammation of the uterus or appendages occurring after labor interferes with normal involution, and gives rise to a series of changes called *puerperal subinvolution*. Irritation or inflammation existing at the time of menstruation interferes with the subsidence of the menstrual development, and causes a persistent enlargement, which has been called *menstrual subinvolution*.

Puerperal Subinvolution.

Symptoms and Diagnosis.—In cases observed within the first week or two after labor or abortion there may be the symptoms of acute endometritis, and infection of the pelvic viscera may appear. These have been reviewed under **ECLAMPSIA**.

In others there may be no symptoms that attract attention until the patient leaves the bed, or begins to use the vessel for a passage of urine or fæces, when she may be taken with uterine hæmorrhage and perhaps with uterine cramps and faintness. There is usually a slight elevation of temperature and some suprapubic tenderness. An examination reveals an enlarged, tender uterus with a patulous os. In cases occurring after labor, or after abortion during the latter half of pregnancy, the finger easily passes the internal os and discovers masses or shreds of adherent placenta. That portion of the uterine wall to which these are attached is usually relaxed, and may bulge into a generally relaxed uterine cavity, or may be surrounded by an irregularly-contracted uterus.

If the placental site is at or near the fundus, a contracted ring may have formed just below it.

In other cases the patient will get up with more or less backache and feelings of weight and pressure in the pelvis, and with some leucorrhœa. The menses will usually become established early, and will be abundant or even profuse.

In acute metritis the pain is deep-seated and diffuse, and radiates toward the loins, hips, and hypogastrium. It is principally intrapelvic, and is accompanied by vesical and rectal tenesmus. Doléris and Pichevin (*La Gynéc.*, No. 6, '96).

An examination reveals a large, soft uterus lying low in the pelvis. The cervix is soft and purplish, and the vagina and perineum relaxed and somewhat deeper in color than natural. In occasional cases a piece of placenta is passed several weeks after labor or abortion.

As the condition becomes more chronic, the uterus remains enlarged, but grows hard, while the cervix assumes a pale, anæmic appearance. Or the cer-

vix may show the signs of laceration, erosion, and ectropion. The later symptoms are those of chronic endometritis. The menorrhagia may persist, or it may finally grow less and be followed by normal or even by scanty menstruation.

Etiology.—Any inflammation or traumatic injury within the pelvis may act as a cause. Retained particles of placenta, laceration of the cervix, and infection are the most common ones.

Retroversion of the uterus, pelvic tumors, getting up too soon, and frequent coitus may also delay or prevent complete involution.

Pathology.—In puerperal subinvolution the uterine muscular fibres and blood-vessels take on atrophic changes much slower than normal. The muscular fibres are longer than natural and relaxed; the blood-vessels are enlarged and surrounded by a serous infiltrate. The walls are purplish in color and soft, are easily injured, and, if injured, bleed freely. This condition may continue for many months.

As a rule, there is a focus of inflammation at the placental site or about a cervical laceration, which causes the ordinary changes of inflammation to extend to a greater or less distance into the parenchyma.

After a time embryonic cells appear between the muscular fibres and about the blood-vessels, and, as they mature, diminish the caliber of the blood-vessels and displace and cause atrophy of the uterine muscular fibres. Thus in time the walls become pale and anæmic, and the connective tissue predominates over the muscular, giving the structure a hard, fibrous character.

Prognosis.—Many cases get well when the endometritis or periuterine inflammation subsides. In those in which large pieces of placenta remain in the uterus

the subinvolution rapidly disappears if these are expelled early and before the uterine walls have become deeply infected. Long retention and infection of retained particles may result in a chronic subinvolution that will persist until long after the menopause. In long-standing cases in which the uterine walls have become hard and anæmic, treatment has but little effect upon the enlargement of the organ.

Parenchymatous metritis is not so important a factor in the etiology of abortion as is endometritis. That form, however, arising from puerperal infection is very prone to induce an abortion should the woman conceive. Syphilitic metritis, also, is a common cause of abortion. Infectious metritis is a most virulent form of the disease, almost invariably resulting in the death of the ovum and its ultimate discharge, and not infrequently in maternal death also. Cumston (Boston Med. and Surg. Jour., Aug. 29, '95).

Treatment.—The prophylactic treatment consists in a complete evacuation of the uterus after labor, the avoidance of laceration of the cervix and of infection, and in rest in bed until the uterus and cervix are firmly contracted and greatly reduced in size.

If after a week or ten days the internal os will admit one or two fingers, the vulva and vagina should be thoroughly disinfected, and the uterine cavity completely emptied by the finger. In many cases the tenderness makes it necessary to administer an anæsthetic to accomplish this. Firm pressure can then be made over the pubes, and the uterus be retroverted or depressed until the fundus can be reached. In recent cases with irregular contraction of the uterus the particles should be sought for until the whole organ contracts and expels the finger. The uterine cavity is then douched out with a 1 to 2000 solution of corrosive mercuric chloride, and the pa-

tient kept in bed for ten days or two weeks.

If the uterine walls are flabby and infiltrated, they will not contract firmly, and more or less hæmorrhage takes place. In such a case the uterine cavity, after being douched with the 1 to 2000 solution of corrosive mercuric chloride, is packed with sterile nosophen or iodoform gauze. This is removed in twelve or eighteen hours and the vagina douched with the same solution, and twice daily thereafter until after the temperature becomes normal.

Cases of several weeks' duration should be treated by curettage and the repair of the cervix.

Ichthyol recommended in metritis. After vaginal irrigation, a 5- to 10-per-cent. solution in glycerin is applied to the neck of the uterus as a tampon; this is followed with inunction of the abdomen several times a day with ichthyol in vaselin, 20 to 25 parts in 100. Rapid diminution of pain and abundant vaginal secretion soon take place, with cicatrization of the ulceration. Calderini (*Revue Gén. de Clin. et de Thér. Jour. des Prat.*, Dec., '93).

While the chief action of ichthyol is to relieve pain, it also possesses certain resorbent qualities, in some cases relatively powerful. Its use is not attended with danger or discomfort, the powdered drug being generally more satisfactory and reliable than solutions. Storer (Boston Med. and Surg. Jour., Aug. 2, '94).

Recovery from septic metritis and general peritonitis after treatment with antistreptococcic serum. Law (*Brit. Med. Jour.*, Jan. 2, '97).

Continued irrigations of the uterus successfully used for acute puerperal septic metritis. Under the influence of continuous irrigation the uterus contracts well and fast. The fissure heals rapidly. Irrigation must be kept up until such time as it is certain that there is no more internal suppuration; otherwise the os, now firmly closed, will retain the discharge, and the temperature will rise

again one or two degrees. Horace Manseau (N. Y. Med. Jour., July 23, '98).

In chronic cases these operations must sometimes be followed by local treatment, such as the application of a 33-per-cent. solution of chloride of zinc every two weeks or by mild galvanocautery.

Review of one hundred and twenty cases of metritis treated by free intra-uterine injections. These found valuable in all varieties, acute or chronic, although in exceptional cases it caused uterine colic, serous discharge, menorrhagia, and sometimes peritoneal irritation. These complications denoted the need of care, though they were of little importance. Suppurative inflammatory lesions demand evacuation of the pus before the injections are begun. Gesna (Thèse de Paris, '99; La Gynéc., Dec. 15, '99).

Menstrual Subinvolution.

Symptoms and Diagnosis.—Menorrhagia exists in many cases. Dysmenorrhœa is common and, although it may be connected with uterine cramps in case there be stenosis, usually persists during and after the period as an aching pain or soreness in the pelvis or sacrum, increased by being on the feet. Headache and hysteria are, if present, worse at such times.

In chronic cases the menses may become scanty, and the patient often claims that she feels badly in proportion to the scantiness, and is apt to demand emmenagogues.

The symptoms between the menstrual periods are similar to those of endometritis.

Examination usually reveals a symmetrically enlarged uterus. The cervix is large and dark red or purple in color, and in the advanced stages is hard. The uterine cavity is from three to three and one-half inches long. The ovaries are usually enlarged and more or less tender.

The uterus may hang low in the pelvis,

or it may be held high up by rigid sacro-uterine ligaments or by adhesions.

Etiology.—The causes include those of endometritis.

Causes which act either in conjunction with endometritis or distinct from it, interfering with the normal post-menstrual involution or retrogression, are as follow:—

1. Mechanical, — such as displacements, tumors, stenosis of the cervix, pelvic exudates, etc.

2. Active inflammation in the pelvis, —such as endometritis, oöphoritis, salpingitis, etc.

3. Traumatism and disturbances of the circulation acting during the menstrual congestion,—such as blows and strains, catching cold, excessive coitus, onanism, and fatiguing or long-continued labor.

Pathology.—In many cases the uterine walls become progressively thicker and the uterus larger, while those in the endometrium do not keep pace with them, or become less and less pronounced. The blood-vessels are enlarged and the tissues infiltrated with serum and migratory cells. The muscular fibres may at first be enlarged, but soon become separated from one another by embryonic cells, which also surround the blood-vessels in large quantities. In time, adult connective tissue forms, which compresses and causes atrophy of the muscular fibres, and diminishes the caliber of the blood-vessels until the uterus may become hardened and purplish in color and finally pale and anæmic.

Displacements of the uterus or inflammation of the surrounding tissues are not uncommon.

At the time of menstruation the congestion is intense and the retrograde changes do not take place normally and completely, and some enlargement or

menstrual subinvolution remains. At each period the enlargement or development is greater, and, the retrogression or involution being imperfect, the uterus becomes permanently and progressively larger, until the formation of adult connective tissue or the menopause prevents the process, and sclerosis supervenes.

Metritis of the cervix and cancer. In doubtful changes of the cervix, no precise diagnostic criterion is possible without an accurate microscopical examination of the tissues removed from the suspected locality. This is also of material assistance in establishing a diagnosis between canceroid of the cervix and other forms of carcinoma. In incipient canceroid amputation of the cervix is sufficient, and there is no likelihood of return of the new growth, less so than after total hysterectomy, even when cancerous infiltration has already invaded the cervical mucosa, or when the malignant process has passed beyond the cervical boundaries. Amico Roscas (*Archivio di Ostet. e Ginec.*, Aug., '99).

Analysis of metritis desiccans in 29 cases reported in literature, showing a mortality of 18 per cent. Symptoms of infection were present in all; either a fragment of the uterus was expelled or else it was found after death loose in the uterine cavity. It consists of sloughing of portions of the uterus from obliteration of its vessels by bacteria. In 6 unpublished cases, 2 were examined bacteriologically; in both the mucosa and adjacent muscular tissue, detached in the course of the disease, were found obliterated by colonies of streptococci. Dachxevich (*Vratch*, No. 6, '99).

Prognosis.—The prognosis without treatment is not good, for the disease runs a very chronic course and the uterus remains enlarged. If treated early and vigorously, a cure may be effected, although sometimes not without a sacrifice of the ovaries.

Treatment.—Mechanical causes—such as displacements, tumors, stenosis, etc.—should be removed. Inflammations

about the uterus must be treated in order that their unfavorable influence upon menstruation shall cease.

In the ascending type of metritis—not that which begins at the cervix, but the variety which proceeds from a pyosalpinx—removal of the tubes alone will not cure the patient, but the uterus itself should be removed. Pilliet (*Progrès Méd.*, May 8, '97).

The uterus should be curetted, unless co-existing exudates or inflammations contra-indicate such an operation.

Curettage for hæmorrhagic metritis in the virgin successfully employed in three cases. In the first two cases—16 and 15 years, respectively—the curette brought away large masses of whitish fungosities, of a firmer consistence than is usually met with in the scrapings of hæmorrhagic metritis in married women; the uterus was afterward packed with iodoform gauze. In the third patient, a girl of 14 years, the curette removed grayish-white fungosities, of a softer consistence than in the foregoing cases. Blanc (*Loire Méd.*, No. 12, Dec. 15, '96).

Chloride of zinc in chronic metritis preferred to curette. It never gives rise to aggravation of inflammation of the appendages which may complicate metritis as the curette often does. The latter requires anæsthesia and confinement to bed; chloride of zinc permits the patient to go about directly after the injection with impunity. In 62 cases treated the solution of chloride of zinc varied in strength from 30 to 40 per cent. A drachm is injected into the uterine cavity and the borax-saturated solution injected immediately after. The danger of forcing the fluid into the peritoneal cavity should be borne in mind, and due care to avoid this accident should be taken.

The injections are painful at first, and transient syncope may occur, but no permanent ill effects were noted. The best results were obtained in hæmorrhagic endometritis, of 26 cases, 22 being cured. In glandular endometritis 8 cures were obtained in 15 cases. When the adnexa were diseased only half of the cases were

permanently benefited. Delbert (*Annales de Gynéc. et d'Obstet.*, Jan., '99).

The application twice monthly of a solution of zinc chloride not only benefits the endometritis, but tends to stimulate the uterus to contraction, and thus favors involution and diminishes the menorrhagia. It may be used as a primary method of treatment, or to follow up a curettage. Before each application the cervix should be slightly dilated with a round dilator. As this treatment is apt to cause some pain for a few hours after its use, it should be followed by rest during the remainder of the day. A slight cauterization is produced by each application, and, if sufficient time be not allowed to pass between them, the patient will complain of more backache or pelvic discomfort than previously. In such cases the intervals must be lengthened or the treatment suspended for a few weeks.

Jequirity highly recommended in chronic granular metritis. The strength of the solution employed is 1 per cent. Borde (*Archives of Gynæc.*, Sept., '91).

The following is useful in hæmorrhagic metritis:—

R. Fl. extract of ergot, 1 ounce.
Fl. extract of hamamelis,
Tr. cinnamom., of each, $\frac{1}{2}$ ounce.

M. Sig.: A teaspoonful every two hours. Chase (*Med. News*, June 19, '97).

Bipolar faradism or mild galvanism of the endometrium will sometimes reduce the uterus in size.

Intra-uterine electrolysis recommended as a treatment of metritis, a silver electrode being employed. Boisseau du Rocher (*La Presse Méd.*, June 29, '95).

Tonics, laxatives, a midday rest in the recumbent position, etc., are indicated the same as for endometritis.

Deep scarification through the speculum relieves the engorged vessels and may abort or palliate the attack. Should pain be intolerable, a suppository of aqueous extract of opium, 1 grain, and

extract of belladonna, $\frac{1}{4}$ grain, may be used. Curettage, if indicated at all, should be thorough. The steps of the operation are as follow:—

1. Anæsthesia.
2. Preparation of the vagina and external genitalia.
3. Dilatation of the uterus, unless it is already sufficiently open.
4. Removal of the infected endometrium by means of the sharp curette.
5. Thorough irrigation of the endometrium with cotton wound- on dressing- forceps and dipped in saturated solution of iodine crystals with pure carbolic acid.

Dilatation, curettage, and drainage of the endometrium in acute infection should be limited in its application. The only cases in which it should be performed are those which will otherwise result in dangerous spreading of the infection.

Curettage is contra-indicated in cases in which the infection has passed to the parametria. E. C. Dudley (*Albert Lea Med. Jour.*, Dec., '98).

Acute gonorrhœa is an absolute contra-indication to washing out of the uterus; otherwise this measure in suitable cases has been largely adopted with success of late years. Gesna (*Thèse de Paris*, '99; *La Gynéc.*, Dec. 15, '99).

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MIDDLE EAR, DISEASES OF.—Over 60 per cent. of all ear diseases are in the middle ear. More adults than children (3 to 1) and more men than women are affected with diseases of this part of the organ of hearing.

Diseases of the middle ear are divided into four general classes; viz.: *acute catarrhal*, *chronic catarrhal*, *acute purulent*, and *chronic purulent otitis media*. All these begin as an acute catarrhal process, influenced, of course, by special conditions of health and diathesis in the patient. As a rule, the acute catarrhal process of the middle ear originates in an acute catarrh of the naso-pharynx and

the Eustachian tube, whence it spreads to the middle ear, which in its normal state is an aseptic cavity. Sometimes it seems that the entrance of cold water, cold air, or some other irritant into the external auditory canal sets up an inflammation in the middle ear; but in such cases it will be found that the naso-pharynx was more or less inflamed and supplied the pathogenic germ to the drum-cavity, congested from disease in the external ear, thus supplying a soil favorable to the growth of streptococci or other pathogenic organisms.

Acute Catarrhal Otitis Media.

Symptoms.—The earliest symptoms of this disorder are a sensation of stuffiness in one or both ears and hissing or pulsating tinnitus, but without pain and altered hearing. Sometimes, indeed, in the early stages the hearing may be hyperæsthetic. Most of us experience this mild stage of acute catarrhal otitis media with a cold in the head. As simple coryza passes off, all ear symptoms go with it, if the local treatment of the nares and naso-pharynx has been mild and gentle, or purely negative. If the conditions in our own naso-pharynxes and middle ears are closely observed when we have coryza we shall notice that, as secretion increases in the naso-pharynx (but not before), the Eustachian tube ceases to open at each act of swallowing as it does in a normal state. The ear may feel more or less stopped, and now and then there may be slight pain running into it from the posterior nares. If in these early stages the naso-pharynx, nares, and Eustachian tube receive no local treatment or only a mild one with a bland, oleaginous spray, we shall perceive that, as secretion in the nares and naso-pharynx diminishes, in the course of from three to six days, the Eustachian tube will open spontaneously (or with an

act of swallowing) and the ear will feel clear once more. This stoppage of the Eustachian tube in the early secretory stages of an acute coryza is beneficial, since it is Nature's seal set against the entrance of pathogenic germs from the naso-pharynx into the normally aseptic middle ear. If this seal is broken, either by forcible blowing of the nose, Valsalvan autoinflation, or the inflation-bag of the surgeon it is done to the injury of the patient, as pathogenic germs are very likely to be forced by such manipulations from the naso-pharynx into the middle ear and an acute purulent inflammation of the drum-cavity set up. Acute catarrhal otitis is as common as acute coryza, and as simple if properly managed; but the transition to acute purulent otitis, a serious malady, will be rapid if the local treatment of acute catarrhal otitis is injudicious.

Diagnosis.—If the membrana tympani be examined in the early stages of a simple acute otitis, it will be seen to have undergone very slight, if any, change. It may look a little pink or even red along the malleus and periphery. But its general surface undergoes no change in appearance or position.

Otitis is very frequent in the newborn and in sucklings. In 47 infants there were 37 cases of otitis,—bilateral in 28 instances. The appearances within the ear in this affection are infiltration and redness of the drum-head, often a projection of the posterior half of the membrane, and disappearance of the apophysis. In doubtful cases an exploratory puncture should be made.

The general and functional signs of otitis in the newborn and sucklings are restlessness at night, the frequent placing of the child's hand to the affected ear, the cry, and the symptoms of meningitis. Broncho-pneumonia is the most frequent cause of death (24 out of 37 cases). Hartmann (*Revue Men. des Mal. de l'Enfance*, Aug., '95).

The physical appearances of acute inflammation of the membrane in infants are usually of no help, for they are frequently absent, and as frequently as not the most that can be seen to be abnormal are the appearances, which show a closed Eustachian tube and perhaps some congestion of the vessels. The main symptoms we have to rely upon are pain and restlessness. W. Dalby (*Brit. Med. Jour.*, July 24, '97).

The following early symptoms suggest the ear as the cause of the illness in infancy: 1. The child constantly endeavors to rub the affected organ. 2. It utters a sharp cry of pain when pressure is made below the meatus. 3. It refuses to rest its head on the affected side. J. H. Marsh (*Brit. Med. Jour.*, July 24, '97).

Etiology.—Acute catarrhal otitis media is caused most frequently by acute coryza. It is rarely, if ever, due solely to any form of inflammation of the fauces without concomitant nasal disease. It is also caused by the naso-pharyngitis excited in the exanthemata: typhoid fever and influenza.

Of 2000 cases of aural disease, 97 of the patients attributed the condition to influenza. The attic was exclusively or chiefly affected in a remarkably large number. In cases in which the inflammation was confined to the attic, Shrapnell's membrane was intensely congested and swelled, sometimes bulging in a sacular form. Kosegarten (*Zeit. f. Ohrenh.*, Dec., '92).

Analysis of 1228 cases of typhoid fever showing that 28 were complicated with acute otitis media. Hengst (*Amer. Laryng., Rhin., and Otol. Soc.*, Apr., '96; *Arch. of Otol.*, May, '96).

Severe cases of measles rarely run their course without involvement of the middle ear; the inflammatory process usually runs its course without subjective, and often without objective, symptoms, and only occasionally perforation occurs. Pfingst (*Pediatrics*, Feb. 1, '98).

If fluids are forcibly injected into the nares of a child in the course of diphtheria, otitis will almost surely result. If the child dreads the injection, then irrigation from a fountain-syringe should

be substituted, or, still better, the washing should be done with the aid of the nasal cup. It is personally believed that an infant's nose should be daily irrigated with normal saline solution. A. Jacobi (*Pediatrics*, Aug. 15, '99).

Possible relation of acute otitis media to pneumonia. Both seem frequently associated with the same micro-organism,—the pneumococcus,—and a number of cases of pneumonia have been personally seen beginning apparently with an acute otitis media. Case in point. Thomas Barr (*Glasgow Med. Jour.*, June, 1900).

The acute otitis media coming on in about the third week of typhoid fever is due to the accumulation of secretions, food, etc., and the decomposition thereof in the naso-pharynx of the weak and recumbent patient. Sepsis is thus conveyed to the Eustachian tube and middle ear. An acute catarrh is set up in these cavities, and a simple catarrhal otitis media is soon followed by an acute suppurative otitis media.

In personal experience, covering a quarter of a century and embracing nearly 5000 cases of the exanthemata, especially scarlet fever and measles, otitis media has been met with as the most frequent of the various complications which may occur during the course of the exanthemata. If the attack be treated immediately upon its appearance, it is not necessary to call in the aid of an otologist. J. H. Fruitnight (*Med. News*, July 1, '99).

Ponfick, with his associates, has observed carefully the condition of the ear in 100 autopsies of children under three years of age. These 100 autopsies he has divided under two heads: Non-infectious diseases, and those from infectious processes, and subdividing these into groups according to the disease. In most of these cases the actual condition, or rather the condition of the middle ear, preceding death was not suspected, and the cause of death is given by the attending physician who had charge of the case at the time of the child's death. In only a few of these cases is the history of the case during life obtained.

Among the non-infectious group is found a heterogeneous collection: 2 of congenital heart disease, 1 of extensive burns, and 3 of non-infectious dermatitis. Of these only 1 was found free of otitis. This was a 5½-month-old infant with a congenital heart disease. Although this would appear to have the least possible connection with otitis, yet the only other case of congenital heart disease in this group was a 1-year-old child showing otitis media in both ears and both drums filled with pus.

In the face of these facts it seems one cannot conscientiously attend any grave disease in children without the most careful examination as to the condition of the ear. It is as much a duty to examine the drum-membrane as it is a duty to examine a rash upon the skin. E. H. Pomeroy (Boston Med. and Surg. Jour., Jan. 18, 1900).

Treatment. — All forms of inflation and aspiration of the middle ear, as also syringing and douching the nares and naso-pharynx, must be most carefully avoided, since all of these manoeuvres tend to force pathogenic germs from the naso-pharynx into the middle ear. If the nares and naso-pharynx are full of tenacious secretions that the patient cannot gently blow from the nose, a moderate use of a spray of Dobell's solution, or simple fluid petrolatum, once or twice daily will soften these secretions and favor their outflow. But no inflations or aspirations of the naso-pharynx should be employed by which to open the middle ears. Both doctor and patient should be taught that the stopped condition of the ear or ears is a preventive of worse conditions in the ear, and must be cheerfully endured for a few days. Watery sprays must be avoided, as a rule, as they tend to "waterlog" the tissues and increase the swelling and discomfort in the nose.

The acute catarrhal otitis media of the exanthemata, of typhoid fever, or grippe originates also by infection from the

naso-pharynx, but, owing to the more weakened condition of the patient in these maladies than in simple coryza, it tends to a more virulent course from the outset. Nevertheless, the simpler the local treatment of the naso-pharynx and ear in such cases, the less likelihood there will be of secondary infection, and the more favorable will be the course of the aural disease in the end. A mild, antiseptic nasal spray to cleanse the naso-pharynx in such cases will be sufficient.

Nasal or pharyngeal catarrh, whether idiopathic or symptomatic of measles or scarlet fever, is frequently complicated by acute middle-ear affections. The disease brings with it the necessity of freeing the nasal cavity at frequent intervals; and the simple blowing of the nose, if violently or carelessly done, as is usually the case, may be a source of danger. It should be done as seldom as possible, as violent blowing only adds to the existing irritation and congestion. If this is not sufficient, the mucus must be made less consistent and removed by an alkaline douche. Fridenberg (Med. News, Aug. 8, '96).

At the very outset of an attack of any one of the exanthemata, the nose and naso-pharynx should be frequently and thoroughly cleansed. A spray with warm antiseptic saline solutions, alternating with a free use of medicated oily sprays containing, if necessary, suitable germicides, will usually be sufficient. W. C. Phillips (Archives of Otol., Apr., '97).

If there is pain in the ear, it can be allayed best with dry heat applied by means of the hot-water bag, hot-water bottle, or hot stone wrapped in flannel. The endeavor to open the stopped ear and to relieve slight ear-pains by inflations, aspirations, and syringings has often converted simple catarrhal otitis media into the painful and serious acute purulent otitis media.

Simple catarrhal otitis media, even when painful, can be allayed by the simple application of dry heat about the

ears, combining it, in those instances demanding it, with an antifebrile treatment of the general system, if this plan is pursued from the outset of the inflammation. There will be no harm in instilling into the ear, if it pains, 10 drops, *warmed*, of a solution of carbolic acid (1 to 40), or one of formalin (1 to 2000), if these can be borne.

Liquid vaselin, pure or mixed with iodoform, has given great relief to pain, in acute middle-ear inflammation, while it seemed to overcome any tendency to suppuration. Iodoformized vaselin was of especial service in cases complicating influenza. Delstanche (*Jour. de Méd.*, etc., June 18, '92).

One hundred cases of acute otitis media treated by instillations of cocaine, 5-per-cent. solutions. Ninety-five per cent. of all the cases escaped suppurative inflammation. Five or 6 drops of the cocaine solution should be instilled as often as pain returns. A single medication, the meatus being closed afterward with cotton, will cause pain to cease within ten or fifteen minutes. Ordinary cases of acute otitis media will subside under two or three days of treatment, the drops being instilled about four or five times daily. Inflammation in the naso-pharynx must be treated also. Wolfenstein (*N. Y. Med. Jour.*, Nov. 5, '92).

For an acute attack of otitis media the indications are to relieve the pain and subdue inflammation. Both of these are best met by filling the canal with water, as hot as it can be borne, immediately applying a compress wrung out of hot water to the ear and side of head; or by the local use of extract of opium or solution of morphine or cocaine. These failing, opiates internally, combined often with salicylate of soda, or the coal-tar remedies may be used. If pain still continues and the membrane is found bulging from retained secretions in the middle ear, an incision should be made in the membrane. J. C. Workman (*Columbus Med. Jour.*, Feb. 18, '96).

In many cases of acute inflammation of the membrane, the use of leeches and hot fomentations will cut short inflam-

mation of the tympanic cavity. Where they fail a vertical incision should be made in the posterior segment of the membrane. Even if no pus be present the incision will do no harm. W. Dalby (*Brit. Med. Jour.*, July 24, '97).

Applications of dry heat to the ear by means of salt-bags, bran-bags, etc., while valuable, lose much of their efficiency because the heat is applied too far away from the seat of disease. A dental instrument personally modified so that dry heat may be applied directly to the tympanic membrane. In otalgia of all kinds it is of great value in promptly relieving the pain. In the dry treatment of otorrhœa it is also of value, the ear being first thoroughly cleansed and the surface then dried with the instrument. Vansant (*Jour. Amer. Med. Assoc.*, Oct. 2, '97).

The advantage of instilling an antiseptic into the inflamed ear, in the early stages *before* perforation of the drum-membrane occurs, is that the auditory canal is thus rendered, to a great degree, aseptic. Hence it is a safer place for the membrana to rupture into, since, when the membrana ruptures and the germs causing the acute inflammation are poured into the outer ear freed from staphylococci by antiseptic instillations, there is then less danger of the entrance of the last-named germs, the promoters of chronic purulency, into the drum-cavity, and secondary infection is less likely to occur.

Irrigation of the external auditory meatus recommended in all cases of scarlet fever or measles, with a solution of 1 in 1000 aqueous solution of corrosive sublimate, with 10 per cent. of added glycerin. R. H. Woods (*Jour. of Laryn.*, etc., Jan., '98).

Acute Purulent Otitis Media.—Acute catarrhal otitis media, instead of undergoing resolution, may pass into acute purulent otitis media, induced by the passage of pathogenic germs from the naso-pharynx into the middle ear.

The organism most potent in the etiology of the otitis media of scarlatina is the streptococcus pyogenes. The less chance there is of contamination from the outer air through the external ear, the more the pyogenic cocci predominate over the rod forms; but, prior to perforation of the membrana tympani, the occurrence of such organisms is not precluded, since they may ascend from the mouth and air-passages. Next to the streptococcus, the most important organisms are the staphylococci albus and aureus. Apparently the diplococcus pneumoniae of Fränkel or the bacillus pneumoniae of Friedländer does not play such an important part in the otitis media of scarlet fever as in that due to other causes. Braxall (Amer-Jour. Med. Sci., Sept. '95).

Case of acute otitis complicated with mastoiditis following the surgical removal of adenoids from the naso-pharynx. This untoward result was largely due to the irrigation of the naso-pharynx carried out before and after the operation. Barr (Internat. Otol. Cong.; Ann. des Mal. de l'Or., etc., Jan. '96).

Fatal case of acute general infection with Friedländer's bacillus in a case of otitis media and empyema of the mastoid. Examination of the pus removed at the operation as well as that obtained at the autopsy, blood from various organs, and urine showed a pure culture of Friedländer's bacillus. Among pyæmias due to Friedländer's bacillus the meningeal form occupies an important place. Brunner (Münch. med. Woch., Nos. 13, 14, '96).

Any condition which conduces to a chronic congestion of the upper air-tract and of the tympanum exposes the middle ear to infection. The general predisposing cause, which, without any lesion of the upper air-tract, may render the middle ear exceedingly susceptible to infection, may be any constitutional condition which lowers the vitality of the entire system. The direct or exciting cause of the inflammation—that is, the means by which the pathogenic bacteria are introduced into the tympanum—is through the external auditory meatus, which is the most simple avenue of introduction, and, at the same time,

the most unusual. The middle ear is most commonly infected through the Eustachian tube. One of the most common etiological factors is the direct introduction of pathogenic germs through the Eustachian tube by the insufflation of water through the nares. When we have to do with a streptococcic and, in a great majority of cases with a pneumococcic, infection, the upper part of the cavity is almost always involved. E. B. Dench (Medical News, Jan. 17, 1903).

Symptoms.—In acute purulent otitis media the pain becomes more intense, the hearing dull, tinnitus louder and distressing, and fever usually sets in if it be not already present. The membrana tympani will be found congested and its features lost in the general swelling of its surface as the inflammation within the drum-cavity advances.

In middle-ear inflammation in early infancy in slight cases there is restlessness, ill humor, loss of appetite, and, in severe cases, the rolling of the head from side to side, sleeplessness, calling out, continuous crying, vomiting, and a discharge of pus. In weakly children the loss of weight is often the most striking symptom. In the most severe cases the temperature may rise to 104° F., or over, and depression almost amounting to unconsciousness, twitchings, and convulsions may, in a short time, lead to the development of the appearances characteristic of meningitis, all of which may disappear at once on the occurrence of otorrhœa. Very frequently there is swelling, with tenderness of the lymphatic glands around the ear, and preauricular œdema. Gomperz (Jour. of Laryn., Apr., '96).

In children under four years of age great confusion in diagnosis often arises in the presence of a gastro-enteritis, symptoms of which may be mingled with those of an acute otitis media, or which may depend more upon the otitis media than upon the gastro-enteritis, though the otitis media may not be recognized promptly. Often, in fact, the latter disease is discovered accidentally, either by observing a discharge from the ear

and improvement in the symptoms of the gastro-enteritis or by touching the auricle or the region near it, when the latter is found to be tender and painful to the touch. Treatment of the ear will be followed by recovery in all respects, in most instances, if the aural treatment has not been deferred too long. E. Ponfick (*Berliner klin. Woch.*, Sept. 20, '97).

Treatment.—In this form of otitis, as in the former, dry heat about the ear will do the most in allaying the pains and sometimes in causing resolution. Warm water or warmed watery solutions of carbolic acid (1 to 40) may be tried, but, as has been said, they may afford little or no relief, though the latter sterilizes the auditory canal and prepares it for either a spontaneous or artificial perforation of the drum-membrane.

In acute suppurative otitis media, previous to rupture of the membrane, leeches are applied over the mastoid and in front of the tragus to relieve pain. These are supplemented by warm, wet cloths, which promote bleeding. Instillations of morphine, 2 grains to the ounce, or a 10-per-cent. solution of cocaine, are dropped into the ear if necessary. When ear-drops are used they are warmed by first dipping the spoon that is to contain them in hot water, and then pouring a small amount into the meatus. When the acute symptoms have subsided the ear is kept clean by syringing with a lotion composed of boric acid, 10 grains, to 1 ounce of water. For a time, daily inflation with the Politzer bag is practiced. F. C. Ewing (*Jour. Amer. Med. Assoc.*, Feb. 29, '96).

Case of facial paralysis which attended on an attack of acute otitis media, persisted in spite of revulsive and antiphlogistic treatment, but completely disappeared on the performance of paracentesis. Damieno (*Ann. des Mal. de l'Or.*; Treatment, June 23, '98).

Inflations, aspirations, etc., must be carefully avoided now, as in the acute catarrhal form, for fear of forcing the pathogenic germs from the middle ear into the antrum and mastoid cells. In fact, in this way the large number of

cases of so-called acute mastoiditis consecutive to acute otitis media are caused. The naso-pharynx may be sprayed, not syringed, with Dobell's solution, in such cases, if the nares are filled with tough secretions; not otherwise. Ordinary gentle blowing of the nose will be quite sufficient to clear the nostrils. Under the above conservative treatment the earache usually ceases in a few days, either with or without spontaneous rupture.

Inflations by either Politzer's method or the catheter or any other method is not only useless, but really dangerous in acute otitis media, as by such means pus may be forced into parts of the middle ear previously unaffected. Walb (*Archiv f. Ohrenh.*, Sept., '95).

Inflation in acute otitis media should not be employed, and the wound should not be irrigated after mastoid chiseling. Hartmann (*Archiv f. Ohrenh.*, Sept., '95).

If pain continues over six hours in a child or twelve hours in an adult, without spontaneous rupture of the membrana tympani, paracentesis of the membrana should be performed, because not only hearing, but life itself, may be at stake in many cases if the drum-membrane is not opened in some way. As the inflammation advances the membrana tympani will be seen to bulge, especially in its posterior half. Sometimes the most prominent portion, however, is in the membrana flaccida. As the inflammation in the drum-cavity increases, the pain becomes most intense, children being thrown into convulsions in some instances, and adults made to writhe and scream with pain. After secretion forms in the drum-cavity and the membrana bulges, no relief can be obtained until an escape is offered to the pus by either a spontaneous or an artificial opening in the drum-membrane. In time, a spontaneous opening will occur; but, as the tendency is for secretion in-

side the drum-cavity to inspissate, the longer perforation is deferred, the less likely it is to occur spontaneously, and then the retained secretions will burrow toward the meninges, sinuses, and brain-cavity, especially in children. Hence the vital indication is prompt paracentesis in a case of acute otitis media with the membrana still imperforate after a few hours of great pain followed by bulging of any part of the membrane.

Early incision of the drum is indicated in purulent otitis. The use of opium and sweet oil and camphorated oil condemned. The only useful local application is a solution of carbolic acid in glycerin, and opium internally to control the pain. The nasal douche is a prevalent cause of otitis. Gradle (*Jour. Amer. Med. Assoc.*, Mar. 30, 1901).

Having sterilized the auditory canal and membrana tympani and illuminated these parts by means of the ordinary forehead-mirror, if the patient is not etherized, an incision must be made in the most prominent part of the membrana. If the patient is etherized an electric head-lamp, referred to farther on, must be employed, as an open flame must not be brought near the patient. If daylight can be used, no artificial light is needed. For performing paracentesis, or, rather, for incision of the membrana, a knife like that shown in Fig. 1 may be employed. Some prefer a knife the shaft of which is set at an angle to the handle, like the one in the illustration, while others prefer, for all operations of the membrana, a straight instrument. An incision 1 to 2 millimetres, or even 3 millimetres, long is far preferable to a mere puncture with the so-called paracentesis-needle, as such an opening is not sufficient for drainage.

Before puncturing the membrane, the external auditory canal should be rendered aseptic by cleansing it with cotton pledgets moistened in 1 to 1000 solution

of sublimate, or 1 to 50 solution of phenic acid. Anæsthesia is produced by a 1 to 5 solution of cocaine hydrochlorate. The point in the membrane to be punctured should be in the postero-inferior quadrant. Mounier (*Ann. des Mal. de l'Or., du Lar., du Nez, et du Phar.*, Oct., '92).

In the last five years 214 cases of acute influenza-otitis observed. In 64 of these the attic, or pars epitympanica of the drum-cavity, was chiefly affected. The treatment consisted in paracentesis when spontaneous rupture of the membrana did not occur promptly. Haug (*Arch. f. Ohrenh.*, May, '96).

Paracentesis is an urgent and essential procedure when the triad of symp-



Fig. 1.

Fig. 2.

Paracentesis-knife and adjustable handle.

toms described by Koerner is present: circumscribed or total bulging of the drum, fever, and pain. If the last two are absent, one can wait, and try rest in bed and applications of acetate of aluminium. Very intense pain, sensitiveness over the mastoid, and the presence of meningeal irritation, are indications for a paracentesis. In the acute stage, irrigations are avoided, but sterile gauze is placed in the ear. Heine (*Deutsche med. Woch.*, Nov. 26, 1903).

Recovery ensues sooner in cases in which paracentesis has been performed than in those in which the perforation is spontaneous.

In a case of earache with congested and bulging drum-membrane the surgeon must be careful to differentiate between simple swelling of the outer surface of the membrana as occurs in so-called myringo-dermatitis and bulging of the membrana from the outward pressure of secretions on its inner surface. In the former the prominence is generally more punctate and sharply defined, often being, in fact, a yellowish, brownish, or livid bulla. In otitis media the protrusion from retained secretions comprehends more of the surface of the membrana, especially in its lower and posterior portions.

In both forms of acute otitis media the condition of the membrana tympani must be watched carefully and constantly throughout the progress of the disease, because only by an intelligent observation of its varying conditions can its treatment be properly conducted.

After either spontaneous or artificial perforation of the membrana there is usually a free discharge of muco-pus, and a cessation of pain, especially after prompt spontaneous opening of the membrane. If this has not occurred and paracentesis has been obligatory, the inspissated secretions escape more slowly at first and the pain gradually diminishes. After any form of perforation of the membrana in acute otitis media a discharge must be regarded as beneficial, as it carries off pathogenic germs. Therefore little or no local treatment of the ear should be applied for fear of secondary irritation of the outer ear and the perforation of the membrana. If this latter condition is established the escape of secretion from the middle ear is prevented, secondary infection of this cavity ensues, and chronicity of the purulency is imminent with mastoid complications. Hence the outflow of pus from the acutely-in-

flamed ear must be favored. The ear should not be syringed at all at such a time, unless the discharge is very thick and not escaping readily. The time to syringe the ear is before discharge sets in, in acute cases, for reasons already given, and not afterward, for fear of secondary irritation of the perforated membrana and infection of the drum-cavity.

In any case of acute purulent discharge, once in twenty-four hours is quite often enough to syringe the ear. Let the ear run and drain itself through the natural drainage-tube: the external auditory canal. Keep the concha and meatus greased with cosmolin to prevent chapping, and mop with sterilized cotton or gauze (do not swab) the meatus and concha as they get filled with secretions. At the same time all forms of inflation, aspiration, and syringing of the nares and naso-pharynx must be avoided. Under these conservative and rational procedures the ear will return to its normal condition in the course of two or three weeks, in most instances.

Good results obtained in the treatment of chronic suppurative conditions of the middle ear from the employment of acetanilid or antifebrin as a dusting-powder. It is best used in combination with equal parts of boric acid. The ear should be cleansed in the ordinary way, and then a fine layer of the combined powders insufflated upon the part. Lewis Somers (Med. News, Apr. 4, '96).

Pyrozone and dilute hydrochloric acid of value in the treatment of chronic suppurating inflammations of the middle ear.

Ten drops of a mixture of 10 drops of dilute hydrochloric acid and 1 ounce of pyrozone should be put into the ear three times a day after cleansing it; the mixture should be left in for five minutes after having been forced in deep by firm pressure upon the tragus. In the primary stage of acute cases such medication is contra-indicated, but, after pain, throbbing, and swelling have subsided, and

suppuration continues, notwithstanding ordinary treatment, the acid and pyrozone check it very promptly. W. Cheatham (Med. Rec., Sept. 12, '97).

Of course, the general health and strength must be regarded and improved in this as in all forms of otitis media. The nares and naso-pharynx may demand either moderate spraying with Dobell's solution once or twice in twenty-four hours, or with fluid cosmolin in which a few minims of eucalyptol or a grain or two of menthol are suspended. Oily sprays as well as watery sprays should be used sparingly, three puffs of the atomizer in each nostril being sufficient at an application.

Acute Empyema of the Mastoid.—

As has already been said, acute mastoiditis consecutive to acute otitis media in a previously healthy ear is usually, perhaps always, the result of improper management of the primary otitic affection.

A large percentage of cases of mastoiditis are the direct result of chronic purulent otitis media, but they are not produced in proportion to the frequency of the latter, and, therefore, there must be some existing condition or conditions that exert an influence in this direction. E. O. Sisson (Jour. Amer. Med. Assoc., Apr. 23, '98).

In every case of acute purulent otitis media there is, in all probability, an attendant empyema of the so-called mastoid antrum. It ought to be called the tympanic antrum, as it is really a part of the tympanic cavity. Sometimes the antrum communicates with the mastoid cells, and hence it has received the name of mastoid antrum. When this cavity participates in the tympanic inflammation and becomes filled with secretion like the rest of the drum-cavity, it will clear itself as easily as the drum-cavity does after an opening occurs in the membrana tympani. This fortunate result in

drainage is assured by a siphonic action which naturally sets in as soon as either spontaneous or artificial opening of the drum-membrane occurs and the outflowing current of secretion is established, as anyone familiar with the regional anatomy of these parts must see upon reflection.

If, however, secondary infection of the perforation in the membrana and of the drum-cavity beyond takes place by infectious treatment through the external ear, secondary infection of the antrum takes place and the patient is then in the first stages of acute mastoiditis. If the antritis is not speedily relieved, the suppurative process may descend into the true mastoid cells, or inward toward the lateral sinus, or forward toward the tegmen tympani and thence into the middle cranial fossa. Sometimes all of these unfortunate lesions occur in the same case. My experience has been that, if an acute otitis media is treated properly from the outset, consecutive mastoiditis will not occur.

Mastoiditis is a most frequent complication of otitis due to influenza. The main points of difference between the mastoid inflammation of simple otitis and that caused by grippe are in the rapidity of involvement to be noted in the latter case and the destructive course of the disease. Adam Politzer (Ann. des Mal. de l'Or., etc., May, '92).

Case of acute mastoiditis following acute otitis media, productive of extradural abscess in a man aged 50 years. Entire recovery ensued upon opening the mastoid and draining the extradural abscess. There was entire absence of fever during the entire course of the disease. Pain and swelling in the mastoid, with cerebral symptoms, led to the exploration and operation. Hennebert (Ann. des Mal. de l'Or., Jan., '98).

The mastoid is probably involved to some extent in every case of acute middle-ear disease. Local tenderness is present in almost every case, with its maxi-

trum over the antrum. Both a profuse discharge and a diminution of discharge are indicative of mastoid involvement, and any bulging of the upper portion of the tympanic membrane in middle-ear suppuration should be looked upon with suspicion. As soon as there is the slightest indication of mastoid disease the patients should be kept absolutely quiet and the bowels freely opened. In addition to this a free incision should be made through the drum-membrane. The value of local depletion is underestimated. Cold is not applicable to all cases, and should never be kept up longer than forty-eight hours, since it masks the symptoms. When employed its use should be continuous. Review of 316 mastoid cases with but 14 deaths, none of which were due to the operation. E. B. Dench (Jour. Amer. Med. Assoc., July 27, 1901).

Symptoms. — If the surgeon is confronted with mastoid empyema in the first or second week of an acute otitis media, he will generally find three prominent symptoms, viz.: pain, prolapse of the upper posterior wall of the canal near the membrana, and pyrexia. The pain is usually in the mastoid region, or on the same side of the head as the aural inflammation, and sometimes there is also earache, being either a continuance of the original earache or a return of it. There may or may not be tenderness on pressure upon the mastoid. If the latter occurs it is said to be usually near the point of the process; but this is not so at first. As the acute mastoiditis is ushered in by acute antritis, if there is mastoid tenderness on pressure at this time it is found over the region of the antrum: *i.e.*, high up and in the front part of the mastoid region close behind the auricle. If acute antritis has taken place and an incipient mastoiditis is before us, we shall find, in addition to pain in the mastoid, a prolapse or prominence of the skin of the upper, posterior wall of the auditory canal, near the drum-

membrane over the position of the antrum. If these two symptoms are present, the third one of the pathognomonic symptoms named above, fever, will also be observed.

Elevation of temperature, though slight, combined with tenderness on pressure over the mastoid process, in a case of acute otitis media of ten days' standing, is characteristic of mastoid disease. Pressure should always be made on both mastoids, however, as occasionally such pressure causes pain in a healthy mastoid. Bulging of Shrapnell's membrane, with drooping of the posterior and upper cutaneous lining of the external meatus, are absolute symptoms of mastoid involvement, and in such it is always necessary to perforate the mastoid cells. Bacon (Trans. Amer. Otol. Soc., vol. vi, pt. 4).

When the bell of the stethoscope is placed against the tip of the mastoid and the handle of a vibrating tuning-fork is held against the mastoid process, some distance from the stethoscope, the sound waves pass from the handle of the tuning-fork through the stethoscope to the ears of the examiner. Any change in the density of the mastoid modifies the intensity of the sound waves, passing through the bone. If the density of the bone is increased, either by osteosclerosis or by the pneumatic spaces being filled with pus or granulations, sound waves are transmitted with greater density; while, if the interior of the mastoid is broken down, leaving the outer wall only a thin shell of bone, the intensity of the sound waves will be materially diminished. Hence, by comparing the results on the suspected side with the results on the opposite side or a normal mastoid, an estimate can be made as to whether the mastoid under consideration is diseased or normal. A. H. Andrews (Transactions American Medical Association, May, 1903).

Treatment. — The presence of acute empyema or acute consecutive mastoiditis in a case of acute otitis media being established, the surgeon must proceed to open the antrum. Many such cases go on

to spontaneous rupture of the outer bony wall of the mastoid and entirely recover, like any other spontaneously evacuated abscess. But, considering the position of a mastoid empyema, so near the cranial cavity, it is not wise to await many days for spontaneous opening, because such an escape of pus from the mastoid may take place on its inner, nearly as probably as on its outer wall. Many cases of mastoid empyema are relieved by spontaneous rupture of the outer cortex, and doubtless many such occurrences are anticipated by a hurried mastoid trepanation. But, with the three symptoms—pain, prolapse, and pyrexia—manifesting themselves in a given case, it is imperative on the surgeon to open the antrum. At such a point in the disease the mastoid skin-surface may present no abnormal appearance, and the surgeon must operate on the indication of the three symptoms or of the pain only.

If a minute fistula in the mastoid cortex should be found after exposure of the surface, this should be followed preferably to making the antral opening at once. The patient being etherized, an incision should be made, running from just behind the temporal artery, half an inch from the attachment of the auricle, around and behind it to the tip of the mastoid process, and the soft tissues retracted, backward and forward, so as to expose the mastoid especially at its upper, anterior position where it merges into the bony auditory meatus, at the so-called suprameatal triangle. The surgeon should proceed to make an opening with a grooved chisel and hammer (never with a trephine), working forward and inward and a trifle downward at first, until he is well under the traces of the zygoma. Ordinarily the antrum will be reached 2 to 3 millimetres beneath the surface of the bone, though at times it

has been necessary to penetrate 6 millimetres before reaching the antral cavity. This opening in the bone should be funnel-shaped, with its mouth outward, and growing narrower as the antrum is approached. By making it of such a shape the cranial cavity is avoided above and the facial canal below. The antrum will be found in such cases to contain pus, and there may be also a few granulations found in it. If the case has been operated upon early in the attack, the quantity of pus will be small; if late in the disease the pus will be found in larger quantity and deeper, often lying against the sinus or over the region of the labyrinth. If the bone over the sinus and over the region of the labyrinth is intact, removal of the pus by gentle lavage from these localities and from the middle ear will be next in order. Granulations especially on the inner wall of the antrum and mastoid cavities should not be disturbed: curettement of these may excite inflammation of the labyrinth or of the sigmoid sinus. If undisturbed they will heal rapidly with the rest of the abscess-cavity, as in any other form of abscess. After lavage of the wound-cavity with an antiseptic, an endeavor should be made to promote healing by first intention. If this is not attained, then, under daily syringing the ear and the operation tract with a bichloride solution (1 to 5000 or 6000), the ear gets entirely well in six weeks at the latest. The ear generally ceases to run before the mastoid wound does, and the hearing begins to improve and is finally often as good as before the ear became inflamed. The mastoid wound in favorable cases gradually closes from the bottom and is healed, as said already, in a few weeks.

If, before the antrum and mastoid have been opened, their inner walls have

become diseased and the cranial cavity invaded, the surgeon is confronted with the most serious and often the most puzzling of all affections, viz.: intracranial suppurative lesions of otitic origin. These last-named diseases are more likely to occur as sequels of chronic purulent otitis media, but they not infrequently follow close upon acute purulent otitis media, especially when the treatment of the primary otitis has been an irritant one and secondary infection has been brought about thereby.

Mastoiditis with Spontaneous Perforation of the Medial Plate of the Process.

—In some instances of mastoid empyema spontaneous perforation of the medial plate of the process occurs, and pus is poured into the digastric furrow of the bone beneath the insertion of the sterno-mastoid muscle. The pus thus liberated from the mastoid cells may find its way, either forward along the tract of the digastric muscle, and point in the pharynx, or backward, toward the nucha,—but beneath the deep fascia of the neck in both instances. This form of acute mastoiditis with spontaneous perforation of the medial plate of the process when it takes place usually occurs in connection with an acute otitis of the middle ear, and has been termed “Bezold’s mastoiditis,” because Bezold, of Munich, recently recalled professional attention to it.

Symptoms.—After pain has lasted for several days or even weeks, in a case of acute otitis media, the pain in the ear and mastoid may suddenly diminish or cease entirely, the otorrhœa continuing nevertheless. The mastoid process may or may not have been entirely free from external symptoms; usually, however, it is free from objective symptoms in this form of mastoiditis and remains so. Within twenty-four hours of the

cessation of pain in the ear and in the mastoid there will be noticed a brawny swelling beneath the mastoid process, extending sometimes both behind and in front of the insertion of the sterno-mastoid muscle, but generally only behind and below the process with a tendency to extend below and backward toward the region of the splenius muscle. Pressure upon these brawny swellings beneath the mastoid may not be very painful, but by such pressure pus can be forced upward, through the spontaneous opening in the mastoid process, through the mastoid cells, antrum, and middle ear, and out into the external auditory canal. A patient in this condition usually shows pyæmic symptoms, and will require an operation for the free escape of the pus now burrowing in the deep, soft tissues of the neck.

The main features regarding the diagnosis of mastoiditis may be summarized as follows: 1. Mastoiditis is always subsequent to purulent inflammation of the middle ear. 2. Tenderness of the bone is an important symptom when present, but the mastoid may be full of pus with absolutely no tenderness. 3. Bulging of the canal-wall is a most important symptom. 4. The absence of temperature is no guide whatever. 5. Improvement in the hearing is usually indicative of subsiding inflammation in the middle ear. 6. The operation is safe; delay may be dangerous. Philip Hammond (Amer. Medicine, April 12, 1902).

Treatment.—The mastoid process is laid open and a counter-opening is made in the neck at the most prominent part of the inframastoid tumefaction, whereupon recovery will ensue. In some cases only the counter-opening in the retro-mastoid swelling, without opening the mastoid bone, already spontaneously perforated, will be required and speedy cessation of all the aural and nuchal symptoms, with recovery of the hearing,

will take place, just as it occurs after prompt incision into an extramastoid suppuration consecutive to spontaneous opening of the mastoid cortex behind the ear and over the outer mastoid surface.

In some cases of Bezold's mastoiditis in which general mastoid symptoms—as pain, tenderness, swelling, redness, etc.—demand it, before the counter-opening is made in the neck to relieve the gravitation-abscess, the outer mastoid cortex is to be opened, the cavity exposed, and the passageway of the pus, through the medial plate of the process, and the direction of the sinus into the neck are to be sought with a probe, and a counter-opening in the neck made accordingly. If the counter-opening in the neck is made promptly,—*i.e.*, as soon as any symptoms of burrowing of pus in the neck-tissues show themselves,—quick recovery ensues. But delay in operating in such cases is generally followed by septicæmia, and sometimes death.

The after-treatment of the wound-cavities in an uncomplicated case of Bezold's mastoiditis with burrowing into the neck is to be conducted on general antiseptic surgical principles.

I have found that, in all cases of spontaneous perforation of the mastoid with discharge of pus beneath the soft tissues, whether the simple form or the Bezold form of mastoiditis, after free incision in the soft parts and escape of pus, especially if fluid syringed either through the ear or through the wound escapes at the opposite end of the suppurating tract, healing takes place promptly under one daily syringing of the tract with a solution of bichloride (1 to 6000) without any trepanation of the mastoid.

Chronic Catarrhal Otitis Media.—Acute catarrhal otitis media, instead of undergoing resolution or resulting in acute suppuration, may pass into a

chronic, hypertrophic, catarrhal otitis media. In such cases it will be found that the naso-pharynx has become the seat of hypertrophic catarrh.

From a study of 600 cases of middle-ear disease the following conclusions have been reached:—

1. Sclerosis of the middle ear is usually the result of previous nasal or pharyngeal disease.

2. Otitis media suppurativa is a common and frequent result of acute or chronic naso-pharyngeal disease.

3. Fully 75 per cent. of all forms of middle-ear disease will show on examination or give a history of naso-pharyngeal disease.

4. Sixty-four per cent. of tympanic affections are coincident with pathological changes either in the nares or pharynx or both.

5. Sclerotic or atrophic changes of the naso-pharynx are of little consequence in the production of deafness as compared with chronic hypertrophy or any morbid change producing congestion of the nose or throat.

6. Of nasal affections, hypertrophy of the turbinals is the most potent factor in the production of aural disease.

7. Aural affections are more frequent in hypertrophies of the post-nasal space or naso-pharynx than in either pure nasal or pharyngeal disease.

8. The effects of passing disease of the nares or pharynx in the production of middle-ear disease is of much importance.

9. General diseases, such as measles, with local naso-pharyngeal manifestations, exert a marked causative influence in the production of middle-ear disease.

10. To a great extent the successful issue of aural disease depends upon appropriate naso-pharyngeal treatment.
L. S. Somers (Univ. Med. Mag., Aug., '97).

Symptoms.—The onset of this form of otitis is gradual; hence it has been called chronic progressive hardness of hearing. After an attack of acute catarrhal congestion of the middle ear the ear may not return to its normal state, but remain the seat of more or less tin-

nitus and of a stopped feeling. The hearing at first is but little impaired, which leads the patient to disregard his ear disease, thinking it will pass off, especially if the impediment is confined to one ear. However, with every cold in the head the ear feels worse and after each cold the noises in the ear and the hardness of hearing increase and are noticed more and more by the patient and his friends. As the symptoms of tinnitus and deafness increase there may be added attacks of ear-vertigo—sometimes called Ménière's disease. These attacks come on suddenly, occurring once or twice a year at first, and are usually not referred to the ear as a cause either by the patient or his physician. In fact, they are commonly considered and treated as attacks of stomachic vertigo or neurasthenia. In some instances the attacks of ear-vertigo are preceded by an increase in the tinnitus aurium, and this may arouse *in the patient* a suspicion that the *ear disease* is the cause of his vertigo. When chronic ear-vertigo sets in, it is in the later stages of chronic catarrhal deafness, and the deafness is generally profound in the ear or ears affected. In every case of chronic catarrhal otitis media there is, very early in the process, contraction of the tensor tympani, retraction of the chain of auditory ossicles, and consequent impaction of the stapes in the oval window. It is this last event that causes compression of the intralabyrinthine fluid, irritation of the motor filaments of the auditory nerve and cerebellar peduncles, with reflex phenomena of vertigo.

If these attacks of ear-vertigo once set in, they gradually increase in frequency from once in six months to once a month and finally once a fortnight. As the patient suffers from nausea and vomiting, as well as inability to walk steadily, or

even at all, and as he may be seized by vertigo and reeling in the street and mistaken for a drunken man, he is unwilling to leave the house alone. His business is interrupted, his nervous force gives out, and his general condition becomes deplorable. Unfortunately, he is often treated now for "neurasthenia," "epilepsy," and even "apoplexy" instead of ear-vertigo. The fact that a patient with ear-vertigo never loses consciousness in his attacks serves to render the differential diagnosis positive.

Treatment.—Since chronic catarrhal otitis media is caused by chronic hypertrophic naso-pharyngeal catarrh, and not by throat disease, the naso-pharynx must receive the first attention and the general health improved—if impaired, as it generally is. The treatment of the nares must be non-irritant, otherwise the ear disease will get worse. Oleaginous sprays are much better than watery sprays, since the former do not "water-log" the tissues like the latter.

Inflations of the tympana are not only valueless, but often injurious, as they but tend to force pathogenic germs into the middle ear, and shock the auditory nerve by impact upon the fenestræ of the internal ear.

The condition of the nares being improved, gentle pneumomassage of the membrana tympani and (mediately) of the ossicles, will be beneficial. This is best accomplished by the Siegle pneumatic speculum, applied under direct inspection of the membrana by the surgeon. There are other forms, but they are likely to be too rough.

Excellent results are often produced by gentle treatment of chronic catarrhal otitis media as outlined above, continued 2 or 3 times weekly for several months, whereas under vigorous treatment by strong sprays, phonomassage, and nu-

merous inflations of and local applications to the naso-pharynx and middle ear, all the symptoms—tinnitus, deafness, and vertigo—increase. In no case will applications to the external ear and membrana do anything but harm.

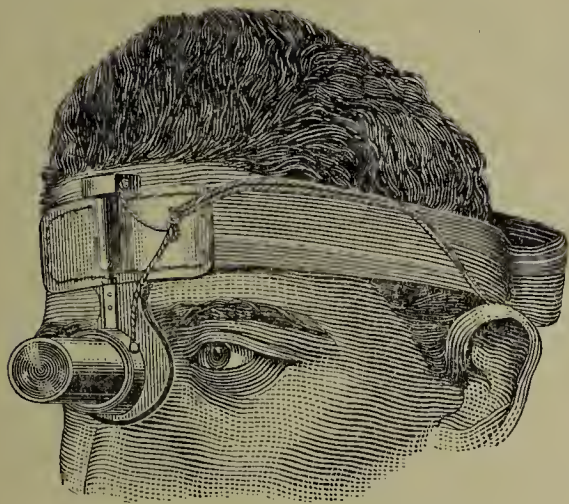


Fig. 3.—Electric forehead-lamp.

If, in spite of rational, conservative, non-irritant treatment of the naso-pharynx, and gentle pneumomassage of the membrana, the ear-symptoms grow worse, resort may be had to removal of the incus. The resultant overcoming of the retraction of the chain of ossicles, and consequent liberation of the stapes, will be followed by diminution and final cessation of the tinnitus and vertigo, and in some cases, by improved hearing.

The instruments required for performing tympanotomy and ossiculectomy are an electric head-lamp, held on the head by means of a band similar to that of the ordinary forehead-mirror, as shown in Fig. 3 and by a set of instruments similar to those shown in their natural size in Figs. 4 and 5.

In performing removal of only the incus the patient must be etherized, the membrana and auditory canal sterilized, and, by means of a knife shown in Fig. 4, *B*, an incision made in the upper posterior quadrant of the membrana, and the incus-stapes joint exposed. The in-

cus must then be detached from the stapes by means of traction outward and downward with the incus hook-knife (Fig. 4, *D*). The descending ramus of the incus must then be seized with forceps (Fig. 5) and gently pulled downward and outward through the perforation of the membrana into the auditory canal and removed from the ear. The meatus should then be stopped with a loose tampon of sterilized gauze and let alone for twenty-four hours. Healing by first intention usually occurs, if the ear is protected with dry sterilized gauze and let alone. Removal of the incus is never followed by inflammatory reaction if the above-named conservative treatment is carried out. If anything is applied to the wound in the drum-membrane or to the middle ear, inflammatory reaction will surely occur.

Chronic ear-vertigo is chronologically the latest symptom or lesion of chronic catarrhal otitis media, being always preceded by profound deafness and tinnitus. It is due to undue impaction of the



Fig. 4.—*A*, Blunt-pointed knife. *B*, Knife for initial incision. *C*, Curved knife for tenotomy of tensor tympani; two-edged. *D*, Incus hook-knife.

stapes in the oval window, as well as to stiffening of the round-window membrane, from the catarrhal condition of the drum-cavity. In a normal ear any inward pressure of the stapes upon the labyrinth fluid is compensated by a corresponding outward movement of the membrane of the round window toward

the tympanic cavity. Any undue pressure from within the labyrinth by influx of perilymph or endolymph from the cranial cavity is compensated by a corresponding outward movement of the stapes, as well as of the round-window membrane toward the drum-cavity. All or any of these compensations being interfered with, intralabyrinthine pressure is increased, the ampullar nerves unduly compressed, and reflex phenomena evoked which are termed ear-vertigo. As these altered conditions of intralabyrinthine pressure are not constant, but vary with the health of the patient and the state of the drum-cavity, chronic ear-vertigo

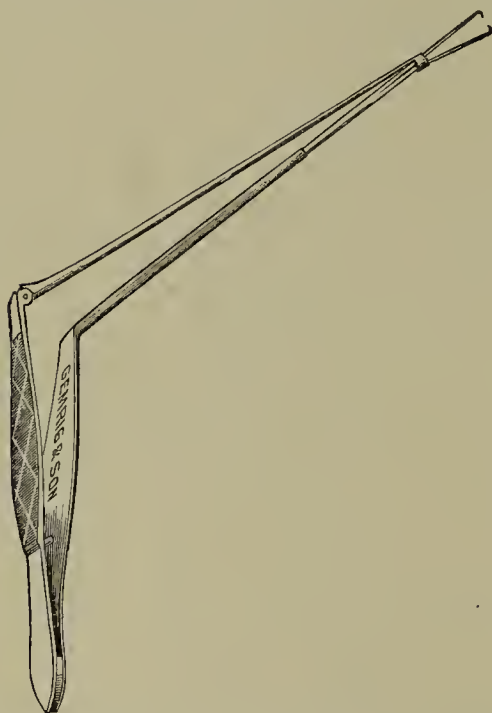


Fig. 5.—Sexton's foreign-body forceps.

is paroxysmal in nature. As retraction of the chain of ossicles and consequent impaction of the stapes in the oval window in chronic catarrh of the middle ear play the greatest part in the production of these vertiginous phenomena, the indication therefore is to liberate the stapes from the superposed incus by removal of the latter, through an incision in the upper posterior quadrant of the membrana tympani of the etherized patient. This procedure resorted to in twenty-seven cases, giving entire relief from vertigo in every instance. C. H. Burnett (*Laryngoscope*, July, 1900).

Vertigo can be divided into four varieties, viz.: (1) vertigo incident to dis-

eases of the heart, (2) vertigo complicating diseases of the stomach and intestinal tract, (3) vertigo associated with diseases of the eye, and (4) vertigo dependent upon diseases of the ear. Vertigo associated with ear diseases is almost always associated with tinnitus. When there is moderate deafness, vertigo is not usually complained of. Vertigo due to aural disorder is either subjective or objective, and the vertigo varies from slight giddiness to an inability to stand up or walk. The vertigo is usually referred to the side on which the lesion exists. The first effort should be to strike at the root of the disorder by restoring the lumen of the Eustachian tube. The most rapid and effective measure of accomplishing this is by electrolysis. The smallest bougie with a tip 1 millimetre in diameter is preferred for the first treatment, and a current of from twenty-five to forty volts, and from 2 to 5 milliampères should be used. Electrolysis, and not cauterization, is desired. The negative pole should be attached to the bougie, and the positive electrode held in the hand. Before passing the bougie the mouth of the Eustachian tube should be thoroughly anæsthetized with cocaine. To be effective the tip of the bougie should pass within the tympanic cavity, and inflation should not be done for forty-eight hours. W. P. Brandegee (*Laryngoscope*, Feb., 1902).

Chronic Purulent Otitis Media.—

Chronic purulent otitis media is due to the permanent lodgment of staphylococci in the acutely-inflamed middle ear. This unfortunate result is usually brought about by improper treatment of the acute otitis media, generally by the patient, but sometimes, it must be admitted, by his physician.

Analysis of 300 cases of suppurative otitis media chronica. Of these 300 cases, 72, or 24 per cent., resulted from scarlatina; 27, or 9 per cent., followed measles; 37 cases were due to naso-pharyngeal catarrh; 4 cases resulted from blows on the ear; 11 cases originated during the first dentition; 7 cases were due to tubercular

disease of the mucous membrane; 3 cases developed after the entrance of salt-water into the ear; 1 case originated during an attack of pertussis; 137 cases are recorded as resulting from "colds in the head." Milligan (Med. Chronicle, Sept., '91).

Symptoms.—The symptoms of this condition are objectively a perforated membrana and more or less copious and offensive discharge from the ear. This hole in the membrane varies from the size of a pin's head to that of the entire membrana.

The membrana loses its lustre first, and sooner or later becomes thick and red, denuded and secreting. When the perforation is large all the ossicles may be visible. Or the malleus, the manubrium being partly destroyed by caries, may be the only one visible. The incus is generally the first to go in part or entirely, as its nutrition is poor.

The stapes is the most resistant of all, especially in its foot-plate, as it is nourished by the vascularity of the inner wall of the tympanic cavity, of which it is practically a part. The head and crura of the stapes may be destroyed by necrosis in some virulent cases. But, as a rule, it persists the longest of the three bonelets, though it may remain invisible through the perforated membrana, because buried in the swollen mucous membrane of the drum-cavity. As this swelling goes down under treatment and the discharge ceases, the stapes comes into view, if still intact. The subjective symptoms of chronic purulent otitis media are hardness of hearing, deafness; tinnitus of more or less intensity, either constant or interrupted; ear-vertigo at times in adults, and in children attacks of so-called "gatherings in the ear," and earache with, of course, impaired hearing and, sometimes, tinnitus. Adults, too, will have attacks of earache if they

allow cold water or cold air to enter the diseased ear, or if they neglect a cold in the head.

Effect of atmospheric changes on the hearing in chronic catarrhal otitis media: The hearing in at least 70 per cent. of cases with chronic catarrhal deafness becomes worse under adverse weather conditions. The danger of impairment of hearing, as influenced by atmospheric changes, is determined to a great extent by the location and character of the pathological process in the tympanic cavity. The morbid alterations most susceptible to barometric variations are those of hyperplasia. In purely atrophic changes in the middle ear weather variations have little or no effect upon the auditory function. Atmospheric influences also impair the hearing by unfavorably affecting catarrhal processes of the upper respiratory tract and Eustachian tube. All things being equal, the impaired hearing in chronic catarrhal otitis is diminished more (under favorable weather influences) in those whose general health is below par than in those otherwise healthy. Seymour Oppenheimer (N. Y. Med. Jour., Oct. 21, '99).

Treatment.—The first endeavor should be to render the external auditory canal and middle ear aseptic. Of course, cotton must never be worn in the chronically-running ear. If the discharge is too thick and too copious to mop out, it may be syringed out of the ear by means of warm water previously boiled. To this may be added a little salt, carbolic (1 to 40), or equal parts of alcohol. Once or twice in twenty-four hours is often enough in the worst cases. If the discharge is not copious it may be removed with an absorbent-cotton mop, previously singed, and then 10 drops of an antiseptic solution may be put into the ear. A solution of formalin (1 to 1000 or 500) or a solution of carbolic acid (1 to 40) may be dropped in, and allowed to lie there a few minutes, and then turned out on a towel. Where there is a tend-

ency to granulations absolute alcohol may be used instead of the above. This treatment may be repeated once or twice a day in the worst cases, then once a day and finally every second or third day, as the discharge lessens. This or a similar conservative antiseptic treatment, persevered in for many months, will usually lessen the discharge and in many cases check it, especially if the perforation of the membrane is below the folds and the disease largely or entirely in the lower part of the drum-cavity, or atrium. If the sole perforation is in the membrana flaccida, and the purulency chiefly or entirely in the attic, or recessus epitympanicus, it cannot be cured, as a rule, by local antiseptics.

Instillation of 10 drops, two or three times daily, of a mixture of dilute hydrochloric acid, 10 drops, with 1 fluidounce of pyrozone found to effect a cure of chronic suppuration of the middle ear, even in attic complication, in a short time. W. Cheatham (Med. Record, Sept. 12, '96).

The disease being limited to the atrium and the perforation being generous, local antiseptics will often effect a cure. The surgeon must persevere for months and even years with such treatment, if he observes that the tendency of the purulency is to lessen, and the condition of the diseased mucous membrane of the drum-space improves. If the purulency ceases under local antiseptics, the hearing may be found to be less after the discharge ceases than while it prevailed. This is due to the fact that in the healing process the partially-degraded ossicles and membrana tympani have been bound together against the promontory and oval window, by synechiæ, and sound-conduction thus impeded. When the largest ossicles are destroyed by necrosis or removed by the surgeon, healing of the chronic puru-

lency of the drum-cavity ensues without synechial interference to the conduction of sound to the oval window, and the hearing is better in such cases than when healing occurs with the ossicles or their remnants in position. If, after six months or sooner, the tendency of the chronic purulency of the middle ear is not toward improvement under the above-named local antiseptics, it is because drainage is defective; antiseptics cannot reach the entrenched staphylococci, and caries and necrosis of the ossicles and, sometimes, of the neighboring tympanic walls, are advancing. This is especially true in chronic purulency of the attic. Such a patient is threatened now with deeper and most serious lesions in the antrum and mastoid cavities, involving the petrous bone on its inner surfaces, in the middle and posterior cranial fossæ. For a consideration of these profound and threatening lesions the reader is referred elsewhere. (See CEREBRAL ABSCESS and ENCEPHALITIS, volume ii.)

In 14,580 autopsies 48 cases were found in which death resulted from cerebral disease secondary to purulent otitis media. Of 17 abscesses, 12 were in the temporal lobe, 4 in the cerebellum, and 1 in both cerebellum and occipital lobe. In 16 cases there was thrombosis of the sinus. Brain-abscess is found almost exclusively in chronic purulent otitis. Poulsen (Münch. med. Woch., No. 24, '96).

Septic infection may pass from the tympanic cavity and mastoid antrum through the labyrinthine spaces and auditory and facial nerves to the cerebellar cavity. Thomas Barr (Arch. of Otol., July, '97).

Chronic purulent otitis media having defied local antiseptic treatment for months, and the ossicles or the petrous bone in their vicinity being carious, the only indication is to remove the ossicles and thus favor drainage from the drum-

cavity and better local treatment of its purulent walls by means of antiseptics. Some advise immediate resort to a mastoid trepanation and deeper surgical measures applied to the petrous bone, for the cure of chronic purulency that has defied for a year antiseptic treatment, without resort to ossiculectomy and further antiseptic treatment. But, in the absence of urgent and threatening mastoid and intracranial symptoms, mastoid trepanation is unjustifiable simply for the cure of chronic purulency. Indeed, in the absence of urgent cranial symptoms, removal of polypi, ossiculectomy, and excision of the remnants of the membrana followed by the application of antiseptics will usually effect a cure of the tympanic purulency, in time, but in any case the condition of the inflamed middle ear is rendered better, thus preventing symptoms demanding a mastoid trepanation in any of its forms.

In 53 cases of chronic suppuration of the middle ear, middle-ear cavities exposed by surgical operation. In 17 instances the suppuration stopped at once; 6 patients died,—3 from pyæmia existing before the operation, 2 from chronic tuberculosis, and 1 from cerebral abscess existing before the operation on the ear. The remainder of the 53 cases continued under observation. A. Politzer (Aust. Otol. Soc., June, '96; Ann. des Mal. de l'Or., Jan., '97).

Of 61 cases operated upon for the relief of otorrhœa, 35 were cured, 17 improved, 1 was still under treatment, and in 8 the result was unknown. In cases where there had been extensive caries, 10 were operated upon by the Schwartze-Stacke method. Of these 6 were cured and 4 improved.

Twenty-six cases of chronic purulent otitis media were operated upon for the purpose of improving the function of the ear. In 22 cases the ossicles were removed. The hearing was improved in 17 cases and unimproved in 5. In 4 cases the operative procedure consisted in the

division of adhesions, and the hearing was improved in every case.

In 20 cases the condition was one of otitis media purulenta residua, the suppurative process having run its course. The local condition was one of rigidity of the ossicular chain, due to the development of adhesions. In 18 of these cases synechiotomy was performed. The operation was followed by improvement in 17 cases; in 1 case the hearing was unimproved. In 2 of these cases the ossicles were removed, resulting in improvement in 1 case, while in the other instance the result was negative.

The total number of cases of non-suppurative middle-ear inflammation operated upon was 59, of which 52 were improved and 7 unimproved. E. B. Dench (Laryngoscope, Mar., '97).

Antiseptics can be applied to the meatus and intact membrane in the same way as in other parts of the body with similar results. An initial thorough purification of the middle ear and meatus, followed by careful packing with double cyanide gauze, is an excellent method of treating certain cases of chronic middle-ear suppuration. Urban Pritchard (Otological Soc. of United Kingdom; Lancet, Feb. 24, 1900).

In chronic suppurative otitis media the removal of the necrotic ossicles and part or all of the tympanic membrane and curetting of the cavity recommended. Removal of the anterior attic-wall to give free drainage and open the way for remedial applications affords the following advantages: It gives free drainage; it affords an opportunity to successfully combat the suppurative process; it is free from danger to life and health; in a large percentage of cases the disease is arrested, the hearing improved, only rarely made worse; there is no deformity or scar. Dry treatment is inadequate because of the *débris* collecting around the ossicles. J. A. Stucky (N. Y. Med. Jour., May 25, 1901).

In all cases of persistent and profuse aural discharge the radical operation is the operation of election. In cases of recurrent aural discharge, associated with lesions of the upper air tract, this tract should first be put in a normal

condition. In cases of persistent but slight discharge from the ear, the operator may advise the removal of the carious ossicles, together with thorough curettement of the middle ear through the external auditory meatus. It should always be explained to the patient, however, that this operation is a tentative one, and that the more radical procedure may be necessary later. E. B. Dench (Medical News, Oct. 17, 1903).

Aural Polypi.—Aural polypi, often multiple, may form quickly, even in

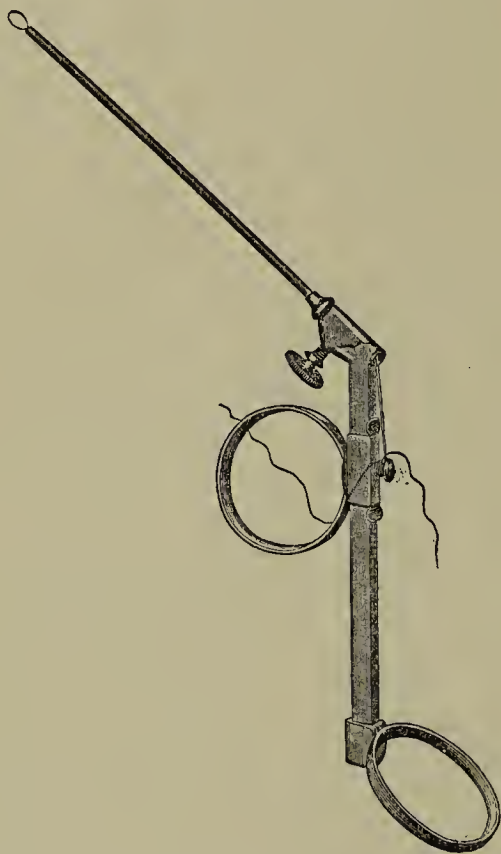


Fig. 6.—Polypus snare. (C. H. Burnett.)

acute otitis media, but, as a rule, they are the result of chronic purulent otitis media.

Symptoms.—Their size varies from that of a small shot to that of a large pea. After attaining the latter size if allowed to grow they become compressed by the canal-walls and elongated, and finally protrude at the external meatus. The outer surface near the meatus in old polypi becomes pale and dermoid. Polypi

are usually attached to the mucous lining of the drum-cavity. If attached to the mucous membrane of the osseous walls of the drum-cavity the growth obtains more nutrition and grows larger than one attached to the mucous inner surface of the membrana. Aural polypi are usually very vascular, but they contain no nerve-structures.

They are of inflammatory origin and constitute true tumors of a benignant nature. Their presence in the ear prevents a cessation of the purulent discharge. Sometimes an aural polypus undergoes a spontaneous detachment.

Treatment.—In the majority of cases aural polypi can be twirled off by means of a probe, under perfect illumination of the auditory canal. Or they may be removed from their pedicles by means of a hook, shown in Fig. 6.

Usually it will be necessary to remove them by means of a snare or polypus-forceps. The best form of polypus-snare is that shown in Fig. 7. It is a Toynbee snare, modified by C. J. Blake, and then further modified by C. H. Burnett. Fine piano-wire (brass) should be used for the snare. Under perfect illumination of the ear by means of the forehead-mirror or an electric head-lamp (Fig. 3), the instrument can be inserted by an expert hand into the ear, the polypus encircled by the loop of the snare and removed with ease. If the walls of the auditory canal and the fundus of the ear are not touched, there will be no pain inflicted upon the patient, as the polypus has no sensation. A better way still to remove a small polypus from the ear is to seize it with a polypus-forceps made like the foreign-body forceps of Sexton (Fig. 5). In the author's polypus-forceps the blades are perfectly straight, and without the teeth of Sexton's foreign-body forceps. After a polypus is

removed from the ear its attachment should be touched with a little absolute alcohol, or a minute quantity of chromic acid. Only as much of the latter as will moisten the end of a probe a millimetre in diameter should be used.

Case of chronic suppurative otitis of thirty-six years' duration. There was a fœtid discharge, hæmorrhage and pain in both ears, found to be due to multiple polypi and cholesteatomata. The polypi were removed, but recurred rapidly; alcohol and glycerin drops were used and all syringing prohibited. The cholesteatomatous masses were also removed gradually with forceps, and these and the polypi finally ceased to reform under the alcohol treatment. The patient has now been free from discharge for a year. Trevelyan (*Jour. of Laryn., etc., Dec., '97*).

Ossiculectomy.—In performing ossiculectomy in chronic purulent otitis media the patient should be etherized, in order to prevent his suffering and to keep him perfectly still,—movement of the head defeats the operation. Ossiculectomy has been performed under local applications of cocaine, but the anæsthesia is not total and the patient flinches or moves more or less. Again, as a good deal of cocaine solution is required, there is some risk of toxic effects.

The patient being under ether, the ear must be illuminated by an electric lamp held on the surgeon's head (see Fig. 3).

The remnants of the membrana over the region of the incus-stapes joint should first be cut away (if not already eroded by disease and the malleus in part or in whole is still present) and the incus looked for. Sometimes the entire incus will be found in position, with its long process in connection with the stapes-head, and its body still in articulation with the head of the malleus. But this is the exception in chronic purulent otitis media. Most frequently the incus is entirely destroyed by caries. Sometimes

the body of the incus, without its long limb, is found fused with the malleus head, and is removed with the latter, when the malleus is seized with forceps and removed from the drum-cavity after severance of its suspensory ligaments, synechiæ, etc. In other instances the body of the incus is partly destroyed by necrosis, its posterior part being intact

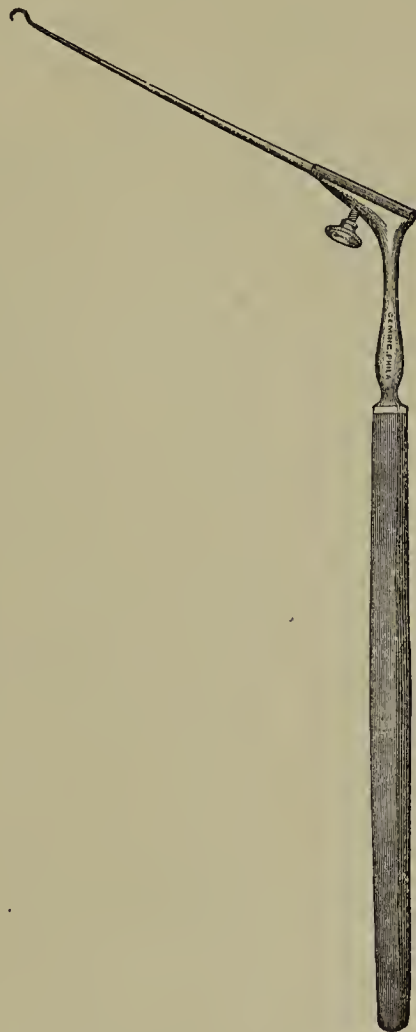


Fig. 7.—Polypus-hook. (C. H. Burnett.)

and the long limb still attached to the stapes. If the incus is present with the malleus, the former should be removed before the malleus is disturbed. If the malleus is removed first, the incus, unless adherent to it, may fall into the lower, posterior part of the drum-cavity and be lost, or recovered only after considerable, and probably irritative, grappling. The incus being found and re-

moved, the malleus may then be excised. Sometimes the remnant of the incus is not found until after the malleus is removed. Then with an incus-hook passed into the attic the incus is thrown forward and downward into the atrium and removed. The stapes *in no case* of chronic purulent otitis media should be removed, nor even mobilized, for fear of opening the oval window and inviting the entrance of pus into the internal ear and thence into the cranial cavity.

Some of the most satisfactory results of excision operations have occurred in cases suffering from chronic otorrhœa. Most frequently the walls of the attic are also carious. Where such is the case, it is of advantage to open this area freely. Having removed the malleus and incus, if no more necrosis exists, the operation is ended; but, if indications show the possible existence of more caries, the antrum is to be opened, the lateral masses of bone between the tympanum and antrum removed, as well as the entire posterior wall of the bony auditory canal. These spaces are thus all laid open into one space. The semicircular canals and facial nerve will not be injured if the lateral walls, only, of the antrum are chiseled away. Stacke (Inter. klin. Rund., Dec. 21, '90).

Extraction of the hammer and incus is only practiced if the greater portion of the drum-head is destroyed, and the hammer, therefore, is of no value for the function of hearing; also, when there is cholesteatoma in the attic. In perforation of Schrapnell's membrane, on the other hand, when suppuration is limited to the attic and the hearing-power is nearly normal, the hearing becomes diminished by extraction of the ossicles, and, in such cases, operative interference ought to be limited to opening the outer attic. Only after this treatment has proved ineffectual should extraction of the ossicles be practiced. In cases where extreme deafness existed there was observed an improvement in hearing after extraction of the ossicles, but, when hearing was very near normal, the oper-

ation diminished it very much. Politzer (Eleventh Inter. Congress, '94).

The initial incision in the membrana may be made with a sharp-pointed knife (Fig. 4, *B*), but further cutting should be made with a blunt-pointed one (Fig. 4, *A*). The incus is best detached from the stapes by means of the incus hook-knife (Fig. 4, *D*), and if adherent to the attic should be turned forward, into the front and lower part of the drum-cavity, by means of an incus hook-knife with a longer and blunter blade than that for detachment of the incus from the stapes. When the incus is entirely freed from its attachments it may be drawn from the drum-cavity by the blunt incus hook-knife, or by means of the foreign-body forceps of Sexton's pattern.

In no case should the drum-cavity be curetted, as such a procedure is very likely to wound the facial nerve and induce facial palsy. It is, furthermore, unnecessary, as granulations will disappear and denuded bone-surfaces be covered in with new membrane, under proper antisepsis.

After removal of the diseased remnants of the membrana and ossicles the ear should be mopped with an antiseptic like alcohol or a solution of bichloride (1 to 5000) or formalin (1 to 1000), the meatus stopped with a light tampon of sterilized gauze, and the ear let alone for twenty-four hours. If the gauze in the ear becomes moist with blood or bloody serum, it should be removed and a dry dressing put in the meatus—not far in the canal. In all cases the discharge diminishes at once, and ceases entirely in the majority of cases within a period ranging from a month to eighteen months. The after-treatment should consist in mopping the discharge from the ear and the instillation of a formalin

solution (1 to 1000) from once a day to once a week, according to quantity and frequency of the discharge.

The hearing improves to varying extents, the general health of the patient is rendered better, and he is freed from the danger of extension of the suppuration to the mastoid and cranial cavities.

Chronic Mastoiditis.—Chronic mastoiditis the result of chronic suppuration may, like the latter, continue a long time without caries and necrosis of either the medial or the lateral plate of the mastoid cavity. In many instances the latter cavity becomes the seat of a cholesteatoma as the result of the long-continued suppuration in the middle ear and mastoid antrum.

It may be safely assumed that in every case of chronic suppuration in the drum-cavity there is a concomitant suppuration in the mastoid antrum, and sometimes, also, in the mastoid cells. If the chronic tympanic suppuration can be controlled or cured the lesions in the mastoid antrum are also cured at the same time. As has been said, ossiculectomy is the best way of curing chronic suppurative otitis and warding off or curing mastoid disease. However, many cases of chronic suppuration are either not treated at all or improperly treated, and the mastoid cavity becomes more inflamed; *i.e.*, its mucous membrane more infiltrated and its drainage defective.

Symptoms.—The disease may now take one of two courses, rarely both: Pain in the mastoid, with headache and fever, without any external mastoid symptoms, may indicate an irruption of pus either into the lateral sinus and posterior cranial fossa or forward into the middle cranial fossa. Or pain in the mastoid and fever may be followed by tenderness and swelling of the outer mastoid surface and spontaneous opening of the cor-

tex, with escape of pus beneath the dense tissues of the cutaneous mastoid region.

To diagnose mastoid disease a small stethoscope is placed over the tips of the mastoid, and the handle of a vibrating tuning-fork over the antrum. If the cells are obliterated or filled with pus or granulations the sounds are much more perceptible than on the opposite or healthy side. Andrews (*Jour. Amer. Med. Assoc.*, Jan. 26, 1901).

Treatment.—An incision should be made and the pus evacuated. The osseous surface should then be fully exposed and the opening in the bone discovered. This should be followed, the bone well chiseled away, and the mastoid cavity thoroughly explored, all diseased tissue, both soft and hard, being removed. If the inner wall is intact, the cavity may be allowed to fill with blood (Blake), the wound drained and stitched, and healing by first intention sought. If, at the same time, all diseased tissues in the middle ear can be removed, entire recovery from the chronic purulency may be expected. If, after exposure of the mastoid and middle-ear cavities, a sinus is found leading to the cranial cavity, the mastoid operation represents but the preliminary to an operation upon the cranial cavity. No operation upon the encephalon for an otitic lesion can be considered complete until the mastoid and middle ear have been opened and the pathway of disease from the ear to the brain sought and followed, and the septic *nidus* in the drum-cavity and the mastoid permanently removed.

The operative procedure in opening the mastoid and antrum cavities in chronic intramastoiditis, by means of hammer and chisel, resembles that described for trepanation of the mastoid in acute mastoiditis. It must be borne in mind, however, that in a case of acute intramastoiditis in an ear previously free

from purulency, we shall find a much thinner cortex than would be found in a mastoid the seat of chronic purulency. In the first instance it is preferable to choose the point of trepanation at the suprameatal triangle and aim at once for the antrum. We make no effort to expose the attic and middle ear and disturb the ossicles, lest we destroy the hearing though we arrest the purulency. In chronic purulent intramastoiditis, always a result of chronic purulency of the drum-cavity, the surgeon in chiseling open such a mastoid should follow any spontaneous opening in the cortex already present, or open at a discolored or softened spot in the cortex, and then aim for the antrum and middle ear, thoroughly explore the middle-ear cavities, and remove all diseased tissues, including the malleus and incus or their remnants, but never the stapes in any case. This bonelet is very resistant to suppuration, and hence prevents the entrance of pus from the middle ear to the internal ear and thence to the cranial cavity. To remove it in chronic suppuration of the middle ear would be to invite the entrance of pus to the internal ear and consequent grave disaster. Every mastoid cavity, and hence every case of intramastoiditis, varies from all others. The surgeon must, therefore, prepare to go slowly, picking his way until he has exposed enough of the outer wall of the mastoid to see his way to the antrum or to the mastoid cavity before reaching the antrum, as is often the case in chronic intramastoiditis. It should go without saying that no one should attempt a radical operation on the mastoid unless he has had ample practice on the cadaver. And he should also be able to penetrate the cranial cavity, by following a septic pathway from the middle

ear and mastoid cavities if one exist and relieve the *nidus* in the brain-cavity.

Ballance's grafting modification of the radical mastoid operation. This consists of two operations: The first, to remove the disease, varies in some respects from the Stacke-Schwarze. The external incision begins above and half an inch in front of the meatus, in the line of the hair, which it follows backward and downward; then forward from the line of the hair to the posterior part of the mastoid apex. The skin is raised for a third of an inch toward the pinna, and then another curved incision is made down to the bone, the soft structures being raised as far as the edge of the bony meatus, as usual. The posterior wall of the bony meatus is removed, and the antrum, attic, and bony meatus are very thoroughly exposed and cleared out. Ballance lays great stress upon the thorough removal of the outer wall of the attic and the efficient curetting of the attic and antro-tympanic passage. The lining of the inferior wall of the canal is divided with a long and narrow knife, well into the concha, when the incision is carried in a curved direction upward and backward to the level of the commencement of the helix. The conchi-meatal flap, formed by the posterior wall of the meatus, is then raised upward and backward and sutured to the mastoid flap by silk-worm-gut threads, raw surface to raw surface. After the packing of the cavities with iodoform gauze the external wound behind the auricle is closed by sutures, the ultimate scar being at the line of the hair.

The second, or grafting, operation may be done in children at the end of a week, but the interval in adults may extend to two or three weeks. In children, unless the wound is foul, the packing need not be removed before the second operation, although the outer dressing of gauze may be changed. The day before the operation the gauze is removed from the meatus and other cavities, which are irrigated several times with 1 to 40 carbolic lotion. On the morning of the operation the cavities are washed out three or four times with warm, sterile saline

solution. The patient being again under a general anæsthetic, the external incision is opened with the handle of the knife, the cavities are exposed, and any exuberant granulation-tissue, or other morbid product, removed from the granulating surface. All oozing of blood should be carefully and thoroughly arrested by pressure with pieces of gauze. The graft is taken from the inner surface of the thigh or arm with a large razor, the surface being first washed and then kept bathed in a normal saline solution. The thinner the epithelial layer removed, the better, even thin to transparency, and one large graft is better than several smaller ones. The surfaces upon which it is specially important to lay the graft are the roofs of the tympanum and antrum and the inner surfaces of the antrum, attic, and lower tympanum. The graft is carried on a microscopic-section lifter and, beginning at the outer edge of the anterior wall of the cavity in the bone, the thin, almost transparent, graft is then insinuated inward from the section-lifter by a probe. A steel probe with pear-shaped head presses the graft into the recesses of the bone-cavities; if possible, no space should be left between the bone and the graft, and, when successful, the definition of the surfaces should be quite clear. Drops of blood or bubbles of air may prevent the due approximation of the graft, and should be removed by suction with a glass pipette. As a protective to the graft Mr. Ballance employs fine, pure gold leaf, which is introduced and applied to the epithelial surface in the same manner as the graft. A narrow strip of iodoform gauze is packed into the cavities, one end of the gauze being brought out through the meatus. The wound behind is again sutured and outside dressings applied. For a week the gauze plug remains; when removed, the gold leaf is seen through the enlarged meatus outlining the attic, antrum, and tympanum. The gold leaf is removed three or four days afterward with forceps, when the white surface of the grafted cavity is seen. A gauze packing is again used, and is changed every two or three days, till the healing process is complete,

the cavity being then quite dry and light pink in color. "This grafting method has proved remarkably successful. The after-treatment is, by it, reduced from many months, or even a year, to five or six weeks, resulting in a more complete and permanent cure." Thomas Barr ("Manual of Diseases of the Ear," third edition, 1901; Jour. of Ophthal., Otol., and Laryn., Sept., 1901).

The early stages of mastoiditis are replete with opportunities for doing work that will not give the patient much relief, but save him from many dangers. In the writer's hands a free incision of the drumhead is very efficient, if a small but strong knife be used, so that the tissues can be laid open to the bone as the blade comes out along the posterior superior wall. Constant cold by the Sprague ice-bag is deemed by the author to be the best antiphlogistic, safe in quite advanced cases, if the tympano (Wilde's opening) mentioned be free and kept free until inflammatory action subsides. Such treatment continued three days after removal of all active symptoms practically prevents relapses. Improvement is usually noticed within twelve hours, if delayed beyond thirty-six hours the external operation is indicated. To rely on these measures it is necessary: 1, That it be an acute case, without symptoms of intercranial involvement; 2, that the patient remain within easy reach; 3, that drainage be maintained by supplementary incision if necessary; 4, that the nursing be intelligent and faithful, so that the ice application shall be constant. S. F. Snow (Transactions American Medical Association, May, 1903).

CHARLES H. BURNETT and

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MIGRAINE. See NEURALGIA AND MIGRAINE.

MILIARIA (PRICKLY HEAT).

Definition.—A vesicular eruption of the skin due to profuse sweating.

Symptoms.—The eruption of miliaria consists of minute vesicles developed near

the pores of the skin. These may be acuminate and red (*lichen tropicus*) and discrete and irregularly dispersed over the surface; or they may be confluent and red at the base (*red miliaria*). At first they contain a pellucid fluid, which occasionally tends to become turbid, then purulent. The eruption is apt to present in parts of the body covered by clothing. The vesicles usually dry up into minute scales. Sometimes the case is attended by lesions simulating those of eczema.

The active symptoms generally consist of a prickling sensation as if thousands of needles were being forced into the skin. This is followed by pruritus, and the case then proceeds to recovery if the irritating factor (heat) is avoided.

Etiology and Pathology.—The immediate causes of miliaria are heat and profuse perspiration. In an examination of specimens removed from patients of different ages, and from different portions of the body, Politzer found that the same conditions were present in all of the sections—an œdematous rete Malpighii, containing dilated sweat-ducts, with no change in the cutis except in the papillary layer, the horny layer of the epidermis being swelled by imbibition.

Treatment.—The treatment is mainly prophylactic: measures calculated to reduce undue exposure of the body to heat. When unavoidable climatic conditions act as cause, frequently repeated bran-baths (a pound of bran packed in a towel being allowed to soak) are sometimes very soothing. A solution of ammonia, a tablespoonful to a quart of water, generally allays the itching very promptly. Sponging with lime-water is preferable in children.

In the graver form Holstein states that thorough cleanliness must be insisted upon; the clothing should be boiled, and sublimate washes or ointments employed.

In some cases the crusts of the lesions may be removed and peroxide of hydrogen applied. This should be repeated daily for several days, antiseptic ointments being applied between-times. The peroxide of hydrogen may be injected into the boils. Carbolic acid, aristol, euophen, resorcin, etc., and lotions of ichthyol (2 to 5 per cent.) made with a saturated solution of boric acid are recommended by various authors.

MILIARY, OR SWEATING, FEVER.

Definition.—Miliary fever is an infectious disease attended by profuse sweating and vesicular eruption of the skin.

Symptoms.—The attacks begin with gastric distress and general discomfort, which may precede the main symptoms by several days; but, in the majority of cases, a person apparently perfectly well will, during the day, complain of great fatigue and feebleness, and in the middle of the night be awakened by a profuse perspiration. The principal symptoms of the first period are, according to Thoinot, perspiration, fever, general debility, and nervous phenomena of diverse nature. Among the latter may be mentioned dyspnoea, usually paroxysmal, and without any pulmonary lesion appreciable upon auscultation; a feeling of constriction in the epigastric region; great restlessness and delirium. Among the more infrequent are muscular cramps, especially in the muscles of the calf and the hand. The tongue is saburral, and constipation is usual.

Two phenomena are especially marked during the second period, namely: cough and epistaxis. The latter may be quite profuse, and occur daily or several times a day. The eruption is generally manifested about the fourth day; very rarely it may appear on the second or third, or it may delay until the fifth or sixth. It

is preceded by itching and persistent tingling, and, as a rule, all nervous phenomena are redoubled for the moment, to be mitigated when the exanthem appears. The eruption consists of two forms: 1. The miliary eruption, properly so called,—that is to say, a miliary papule which appears as a little acuminated point upon the cutaneous surface, and is slowly transformed to a vesicle, which discharges and finally exfoliates. 2. The exanthem, which is the substratum, the base of the miliary eruption. This may be classified into three forms: the rubeolar, which is composed of crescentic patches, more or less confluent; the scarlatiniform, where the cutaneous surface is of uniform coloration; and the amorphic or purpuric form, the cutaneous surface being tinged a dark red, which does not disappear upon pressure, and in which purplish patches are to be observed.

MILIARIS ALBA.—Under this name may be described a special variety of the eruption, consisting of diaphanous vesicles upon a normally-colored skin. The sweating becomes less marked as the eruption progresses, the skin remaining moderately moist; fever is less active; general debility and cephalalgia diminished. Nervous phenomena become quieted. The pulse-rate greatly diminishes, falling often to 55 in a minute; cough becomes more frequent, auscultation revealing bronchial râles; constipation persists. The stools are of the consistence and appearance of tar, and quite fœtid. The urine, which at first was diminished, and in some cases totally suppressed for several hours, resumes its normal characteristics. Albuminuria is not to be found. Epistaxis continues in some cases, other hæmorrhages being added. Hæmoptysis occurred infrequently.

The third period is that of desquama-

tion, which process may take place discretely at separated points, or in large patches. The disease has virtually come to an end when the eruption appears, and usually about the eighth or the tenth day convalescence begins. This is uncertain and tardy.

The convalescents present pronounced anæmia; very often there is œdema of the lower limbs; the muscles of the face exhibit fibrillary tremors; the tongue trembles after the fashion of the tongue of paralytics; insomnia, persistent anorexia, and a tendency to profuse perspiration upon the slightest exertion, are noticed. Among the rarer phenomena are rectal crises analogous to those of locomotor ataxia, crises of costal neuralgia, and irregularity of the heart. These phenomena disappear gradually, but it may be two months or more before the last trace of the disease has been effaced.

Among the anomalous forms of the disease is that without eruption and that without sweating.

Etiology.—Miliary fever is not transmissible by contact, but by infection, according to Thoinot. It is, in all probability, of microbic origin. The period of incubation may be very short,—less than twenty-four hours. The maximum period cannot be fixed. Neither age nor sex appears to have any influence upon susceptibility, but the disease manifests a curious predilection for children and robust men, as also for alcoholics. It is endemo-epidemic in France, England, Germany, and Italy. It recurs in the same patient. It may pass from the mother to the fœtus.

Most epidemics occur in the spring and summer.

Report of epidemic that occurred in Austria in 1893 and which continued almost three months. Out of the entire population of the district, 5079 persons,

159 suffered: 128 children, 17 men, and 14 women. Schaffer (Wien. med. Blätter, No. 32, '93).

Treatment.—The treatment is purely symptomatic, the aim being to alleviate the irritation of the skin. Bran luke-warm baths or sponging with lime-water tend greatly to allay the itching and encourage the resolution.

Internally, quinine has been found efficacious. Calomel in small doses, when administered early, is thought to shorten the disorder. The measures adopted for the treatment of scarlatinous rash is also applicable here.

MILIARY TUBERCULOSIS. See TUBERCULOSIS.

MILK-SICKNESS.

Definition. — A disease, usually met with west of the Allegheny Mountains and in North Carolina, thought to be communicated to man by milk, butter, cheese, and meat obtained from lower animals suffering from the “trembles.”

Symptoms.—The early symptoms resemble somewhat those of typhoid fever: lassitude, languor, anorexia, dull headache, and thirst. After a few days the fever becomes marked, there is gastralgia, nausea and vomiting, a heavy breath, and, as a rule, constipation. The tongue appears enlarged, and when drawn out is tremulous. The foetidity of the breath becomes so great as to constitute a characteristic feature; it suggests, according to Graff, that observed in variola. Nervous manifestations soon become noticeable, restlessness and convulsions alternating with periods of apathy and somnolence, gradually merging into a low typhoid state, during which the patient may succumb.

The mortality of this disease was quite large when the Western States were first

settled, but the prevalence of the disease and its death-ratio have gradually decreased. The clearing of forests and the drainage of marshes are thought to have done much to bring about this result.

Under proper management the prognosis is usually favorable. The active stage of the disease is very variable, however, and death may occur as early as forty hours after the onset. On the other hand, the disease may last a month.

Etiology and Pathology.—As stated, the disease is thought to occur in man as the result of infection from food derived from animals suffering from the “trembles.” Beef, veal, and mutton represent the most dangerous meat in this connection, cattle and sheep being susceptible; milk, butter, and cheese obtained from cows and goats, especially the first named, however, are thought to constitute the main sources of infection. The toxic character of these contaminated foods have been proved by experiments, dogs fed on them having died within a few days. The pathological lesions have not been established. The disease, as it occurs in animals, is thought to be of telluric origin.

Treatment.—Prophylaxis is of primary importance. Unfortunately, the disease may be latent in an infected animal before active symptoms appear. In the cow, for instance, the “trembles” may only become apparent when the animal is rapidly driven, though her secretions may, according to Graff, be infective. When the active symptoms appear in an animal, staggering and trembling are the first symptoms to draw the attention of the herder; anorexia and congestion of the conjunctiva are then noticed, and rapidly followed by spasmodic jerks, convulsions, and death. The existence of the “trembles” in neighboring districts should awaken the watchfulness of the

local physicians and these should institute active measures to prevent infection of the inhabitants.

As soon as a case is recognized, a saline purgative should be administered and the elimination of the toxic elements encouraged by the copious use of pure water and diaphoresis. The supporting measures now indicated are mainly useful in sustaining the patient through the period during which the system is gradually freeing itself of the poison ingested.

MISCARRIAGE. See ABORTION.

MITRAL VALVES. See VALVULAR DISEASES OF THE HEART.

MORPHINE, OR MORPHIA. See OPIUM.

MORPHINOMANIA AND OPIUM HABIT.

Definition.—Morphinomania and the opium habit may be defined as an irresistible craze for morphine, opium, or any of the preparations of the latter drug. The term “morphinism” is applied to the symptom-complex resulting from the undue use of morphine.

Symptoms.—Though the effects of the drug may be somewhat modified by the idiosyncrasy of the individual opium *habitué*, there is a certain train of symptoms which usually follows the consumption of a dose sufficient to procure the characteristic action. A few minutes after the dose, with a shorter interval when given hypodermically, the face is suffused with a blush, with probably a well-defined hectic spot. The eyes sparkle with unwonted brilliancy. The countenance is ruddy and the expression animated. This is the stage of excitement or exhilaration. The pulse beats faster and muscular activity is increased.

This exhilaration gradually subsides into a sense of complete happiness, satisfaction, and repose, with a slower pulse-rate and muscular quietude. This constitutes the second stage.

A vacant look, with an occasional gleam of momentary consciousness, ushers in the third stage. The opiated gradually sinks into a state of torpor, from which he is with difficulty aroused. The only effectual means of arousing him is to administer a fresh dose of the narcotizing agent. The face looks pale or dusky, the skin is withered, the pupils are contracted to the size of a pin's head.

The vascular system is relaxed in the first stage and slightly tightened up in the second, this contraction being intensified in the third. The awakening from the third stage of torpor-prostration, and apparently impending death, is wretched. Tremors are succeeded by growing restlessness, and with returning consciousness there is an overwhelming sense of intolerable uneasiness, distress, and depression, which imperiously craves for a renewal of the bewitching soporific. In this state of reaction the agony, or desperation, is sometimes so acute that suicide or homicide has been the issue.

Case of a morphinomaniac, who was affected with somnambulistic spells, when he would get up during the darkness of night, resume his official work in his office, and indite papers full of figures, all found accurate when he awoke to consciousness. Brazier (Alienist and Neurologist, July, '92).

The quantity taken is sometimes enormous. In one case of female addiction I have known as much as one pint of laudanum drunk daily; and in a male case 150 grains of solid opium eaten in the same period, and 31 grains taken at one dose. One male patient injected 20 grains of morphine per diem in divided doses

under the skin. Another took 60 grains on an average each day. But the ordinary amount of the narcotic usually taken by opium inebriates is very much less than any of these extraordinarily excessive quantities. In my observation the average daily allowance of laudanum has been rather over 1 ounce, of opium about 30 grains, and of the hypodermic self-administration of morphine salts about 8 grains. These quantities, as well as the more excessive, have sometimes been taken daily for periods of months and years.

Case of physician's wife who, after 40 grains hypodermically and one or two 5-grain doses daily by mouth, advanced to from 60 to 75 grains daily of morphine by the mouth only, and at one dose. Afterward she resumed the hypodermic injection of 40 to 50 grains. One laudanum-taker of twenty-two years' standing reached nearly a pint per day. J. B. Mattison (*Times and Register*, Oct. 18, '92).

Case of double addiction (morphine and cocaine) whose daily ration was 60 grains of morphine sulphate and 70 grains cocaine hydrochlorate hypodermically; and one of laudanum, 17 fluid-ounces being taken daily. S. Lett (*Times and Register*, Oct. 18, '92).

My experience is that among male adults the increase is chiefly in opium-smoking and morphine injection, and, among females, mainly in laudanum.

Opium smoked is more quickly absorbed than opium eaten, but it is less harmful, as only a comparatively limited quantity can be inhaled at a time. With the latter mode of use there is greater disorder of digestion. Opium drunk in a liquid form may be classed alongside opium taken as a solid. The speedier absorption of laudanum is more than counterbalanced by the smaller quantity that can be taken on account of the larger bulk. The hypodermic injection of morphine is, however, the most swift

and the most potent of all the methods of administration. The effect is almost immediate. The simplicity, ease, and celerity with which the narcotic effect can be secured have combined to make this subcutaneous process of self-administration peculiarly popular and seductive.

No one can describe the torture experienced by opium inebriates on the failure of the supply of a fresh dose at the accustomed time. While in this fatuous, listless, irritable condition, the patient will at once become lively, clear-headed, and brilliant on the exhibition of a sufficient dose. This depraved physical state is a pathological condition: a physical depression which clamors for a renewal of the potion as soon as the pleasurable effects of the preceding dose have disappeared.

Alcohol infuriates many of its users. Opium, on the contrary, while its effects are somewhat varied, comparatively rarely hurries its devotees into a thousand extravagances, eccentricities, and misdeeds. In alcoholic public-houses are frequently to be heard heated arguments and disturbances. In opium-dens there is usually an atmosphere of quiet and repose. Withal, however, opium in some cases begets foolish and fatuous acts. On the inhabitants of the Malay peninsula, as on a few other peoples, opium seems to have sometimes an excitable effect. A large dose will affect some Malays so that they will "run amok," attacking everyone in their way.

The alcohol-inebriate is often notoriously untruthful, the opium inebriate only comparatively so. He usually pleads guilty if accused of the habit, and readily tells you about it, although some opiists, like many alcoholics, will deny that they ever touch the drug, though at that very moment they are consuming it.

The testimony on oath of the habitual morphine-taker is worthy of discredit in legal matters. Henry Freeman Walker (*Med. Rec.*, Nov. 16, '95).

Patients suffering from morphinism are liars. They become slovenly, dirty, and untidy. Physically, they are thin, sallow, and anæmic; they look prematurely old, their hair falls out, their teeth decay, their nails become brittle, and they suffer from dyspepsia and great constipation. The mouth is dry and the pupils are contracted. Hale White (*Guy's Hosp. Gaz.*, Mar. 19, '98).

The opium-drunkard is, on the whole, more of a slave than the alcohol-drunkard. It is more difficult to keep within limited indulgence with opium, so that "moderate" or "restricted" opium consumption is very much more difficult of accomplishment than "moderate" or "restricted" drinking of alcohol intoxicants. It must not, however, be supposed that a continued moderate or restricted consumption of opium is impossible. In opium-using countries the majority are able to limit the quantity which they consume.

Many male opium-inebriates are impotent, the capacity returning on discontinuance of the narcotic habit. To a less extent an allied phenomenon is exhibited in females, failure of conception frequently taking place after the habit has been fairly launched. Amenorrhœa and irregular menstruation are common.

Menstruation seriously interfered with or entirely suppressed in nearly all cases of the morphine habit. Sherman (*Med. World*, Nov. 8, '88).

Cessation of menstruation in cases of insanity treated by morphine injections for a continuous period, with return of menstruation upon cessation of the morphine. Roller (*Berliner klin. Woch.*, Nov. 26, '88).

Morphine does not abolish the sexual appetite in women. Offspring are generally born with congenital heart disease. Hoppel (*Med. and Surg. Reporter*, Sept. 10, '92).

Morphine produces impotence in the male and amenorrhœa in the female. Editorial (*Med. Rec.*; *Bull. of Pharm.*, June, '97).

The effect of long-continued opiumism is seen rather in nervous disquietude and excitability, leading to speculation and gambling. There is frequently associated immorality, the latter vice being encouraged for purposes of gain by many keepers of these dens. There is an erotic influence in many cases during the earlier stages. Murder has been committed in the ungovernable fury of disappointed narcotic lewdness.

Simple morphinism rarely causes a state of mental alienation sufficient to allow a plea of irresponsibility. It never produces irresistible impulse, but in the more profound disturbance, known as morphinomania, irresistible impulse and other pronounced mental disturbances may occur. Regnier (*Essai Crit. sur l'Intox. Chron. par la Morphine et sur ses Diverses Formes*, '90).

A common feature of all narcotic inebriety is the frequent perversion of the affections. Love is transformed into hate, and the narcomaniac not unseldom loathes the sight of the devoted companion whom, in his prenarcotic years, he cherished with the tenderest affection. Opium transforms the manly, high-toned, pleasant companion into an effeminate, driveling, querulous bore.

In some localities, especially in China, the opium degradation is so terrible that gross immorality abounds. So intense is the crave that a man has been known to mortgage his mother and sell his wife to gratify it. One man sold his wife for £12, and smoked the proceeds. This crave robs a man of his resources, unfits him for work, and hurries him to an untimely end.

To opium is due a large percentage of mortality among children: crime, murder, and disease. More than three-fourths of between 800 and 900 prisoners in Jeypore

Central Prison used opium, quite one-half of them to excess. Valentine (*Indian Med. Gaz.*, June, '91).

One hundred thousand persons commit suicide by opium every year in China. J. L. Maxwell (*Lancet*, Jan. 28, '93).

In Hardoi, of 180 suicides in three years, 97 were from opium, 80 per cent. of these being women. McReddie (*Lancet*, Jan. 28, '93).

Morphine produces abulic states, which predispose to imperative conceptions, leading to theft, usually of a senseless type. J. G. Kiernan (*Jour. of the Amer. Med. Assoc.*, Dec. 11, '97).

Diagnosis and Complications. — Although it has often been asserted that the opium-slave is easily recognized by his glazed eye, hollow cheeks, wasted frame; dry, parchment-like skin; slothful habit, and livid countenance, the opiomaniac and morphinomaniac are often difficult of detection, if they have a supply of the drug about them.

[In one case, a brilliant young medical student had habitually taken opium for two years without the habit having been suspected by the chum who shared his rooms. The truth was disclosed unexpectedly, owing to an unusually large dose having been taken by mistake. It is astonishing how dextrous with the hypodermic syringe the inebriate becomes. I have seen a body speckled all over, except on the head, face, and neck, with minute, dark, indurated spots, though usually the thighs are the favorite injecting field. NORMAN KERR.]

The diagnosis of morphinism is easy. On examining the arms, scars caused by the use of the hypodermic syringe are readily seen. Hale White (*Guy's Hosp. Gaz.*, Mar. 19, '98).

Case in a physician who had a marked albuminuria, absolute anorexia, and obstinate constipation. The skin was pigmented dark brown and the patient deformed, the entire body leaning to the right, this being the result of infiltration of the abdominal parietes by an inflammatory process. There were also innumerable abscesses in the skin. Gradual withdrawal of the drug resulted in cure.

M. Paul Sollier (*Le Progrès Méd.*, May 12, 1900).

In quite a number of cases of opiate inebriety I have noted that a spell of inebriate indulgence is invariably accompanied by severe persistent pain in the epigastric region, yielding after a few days of abstinence. So characteristic has this pain been that I have been enabled thereby to diagnose secret inebriety of both forms.

Symptoms resembling ague are occasionally seen, in both the presence and absence of the narcotic. There are high temperature and shivering, like the cold and hot stages of intermittent fever. There is also an opiate and morphine trembling delirium, exclusive of the acute wakeful and trembling delirious state supervening on sudden withdrawal.

Chronic dysentery is a frequent complication in confirmed opiomania. Dyspeptic and neuralgic painful troubles are among the most common ailments, thus provocative of, or intercurrent with, opiomania. A harassing cough is an occasional complication.

Evanescient albuminuria at times occurs, during the exhibition of the drug and also after its discontinuance. It is apt to last for a few days at a time and to recur at intervals.

Permanent albuminuria may develop under prolonged abuse of morphine. Huchard (*La Sem. Méd.*, May 14, '90).

Two cases of opium-eaters, each taking more than 4 drachms of the drug daily, who suffered from albuminuria. Hingoli (*Indian Med. Record*, Apr., '92).

Cirrhotic and nephritic disorders are infrequently seen with opium. It is almost a tradition of the medical world that disease of the kidneys is apt to occur in the person of morphinomaniacs and opiomaniacs; but, though I have always been expecting to discover albuminuria in this group of narcomaniacs, I have

never yet detected albumin in their urine, except when the kidneys were affected with organic kidney disease prior to the development of the narcotic symptoms.

Morphine can be detected in the urine.

The urine in morphinomania reduces sulphate of copper if heated with caustic soda, and gives, although slowly, an abundant precipitate of copper oxide, while polarization and fermentation give a negative result. With phenylhydrazin a precipitate of osazone, about 46 grains to the quart of urine, is obtained. This osazone is distinguished from glucosazone by its point of coagulation, 316.4° F., which is much lower than that of glucosazone, and by the fact that it is soluble in water. Salkowski and Jastrowitz (Centralb. f. d. med. Wissen., No. 19, '92).

To detect morphine about twenty ounces of urine are collected from the suspected person. If it has not an acid reaction it should be acidulated with dilute hydrochloric acid and concentrated to about three ounces, when it is allowed to stand in a cool place for twelve hours; then filtered. To the filtrate is added sufficient sodium carbonate to render it alkaline. It is then allowed to stand twelve hours; filtered and the precipitate collected and washed with distilled water made slightly alkaline with sodium carbonate and dried. The dried precipitate is digested with pure alcohol at a gentle heat and filtered. This is evaporated to dryness, the residue is dissolved with dilute sulphuric acid, and tested for morphine by the iodic-acid test, or other well-known tests. By this method morphine can be obtained from persons taking but very minute amounts of the drug. Stephen Lett (Lancet, No. 8, '98).

The temperature is lowered by alcohol sometimes several degrees, and slightly raised by opium.

Etiology.—Opium-inebriety is much more common in the United States than in Great Britain. It is computed by Crothers that there are 100,000 opium inebriates in the great American repub-

lic. For one case in England, I have known thirty in the United States, and I have had the opportunity of observing in person the enormous consumption in some of the States of the American union. The medical profession seems to afford the greatest number of victims.

Of 545 morphinomaniacs, 289 were doctors. Lacassagne (Brit. Med. Jour., July 15, '93).

Seventy per cent. of personal cases were medical men. J. B. Mattison (Jour. of the Amer. Med. Assoc., Aug. 4, '94).

Of male morphinists, the medical profession supplies the largest number: 40 per cent. Men of leisure come next, with 15 per cent.; then merchants, 8 per cent.; while peasants, clergymen, and politicians occupy the lowest positions on the list. Women of means are the most numerous class among the females, 43 per cent.; followed by wives of medical men, 10 per cent. Editorial (Med. Record; Bull. of Pharm., June, '97).

Statistics as to morphine *habitués* treated in Prussian sanitariums show that, of 62 male patients, almost one-third were physicians, and of 18 married female patients, 3 were wives of physicians. Editorial (Phila. Med. Jour., Oct. 8, '98).

The reports from private asylums and public hospitals show that within five years medical men form a considerable part of their inmates. Specialists of nervous diseases sustain the same fact. The young and the middle-aged men are the most common victims. Often they are from that class of delusional therapeutists who want to prove everything by personal experience, or who have exalted conceptions of the power of drugs, and believe that researches in that direction will open the road to a physical millennium. T. D. Crothers (Med. Record, Nov. 25, '99).

Since 1884 there have been admitted into the Pennsylvania Hospital for the Insane 31 physicians who were addicted to the use of alcohol or some drug. In many of these cases the patients used both alcohol and morphine and several alcohol, morphine, and cocaine. In these

fifteen years the hospital has received 1023 men. On the other hand, being a hospital for the insane rather than a retreat for inebriates, it probably only receives those patients who have somewhat deteriorated by reason of their habits. These 31 patients, however, were not so advanced as to require certification, but went voluntarily to the hospital. The above does not confirm Dr. Crothers's charges that from 10 to 20 per cent. of physicians are intemperate in the use of alcohol and drugs. Editorial (Phila. Med. Jour., Nov. 25, '99).

A very short time suffices for the establishment of opium-inebriety. It is, not infrequently, silently, yet surely, set up in from four to six weeks. The period of incubation varies in duration with the idiosyncrasy of the subject and the means at his disposal of procuring supplies of the deceiving drug. The initiation of the practice of opium- or morphine-taking shows some different starting-points than those from which inebriates set out on an alcoholic career. The most frequent apology with which I have been favored by opium- and morphine-inebriates has been that they first had recourse to the drug to procure sleep. Insomnia, an increasing trouble in these days of mental overpressure and overstrain, is frequent among literary workers and members of the learned professions.

In the United States the intense nerve-activity and exhaustion of the people, and, within extensive tracts of country, the prevalence of malarial fevers of a low type, with their depressant sequelæ, are the principal introductions to opium-inebriety.

A sedative for the relief of pain has been the origin of the habit with nearly as many. Obscure and intense neuralgic pains being generally relieved as by a charm by morphine introduced subcutaneously, this also is a frequent inauguration of the habit. The enormous

amount of opium given to children in the form of soothing syrups has much to answer for in the increase among us of opium indulgence.

[Twenty years ago a gentleman who was a martyr to unbearable attacks of sciatica of a purely neurotic origin, who had been thoughtfully treated and kept from this perilous practice by his medical attendant, went off to consult one of the greatest surgeons of that day. The patient in a day or two thereafter returned exulting to the family physician, exhibiting the hypodermic syringe which had been ordered by the consultant, and demonstrating the dexterity with which he could perform the operation. The unfortunate sufferer had not the slightest idea that this self-medication involved any danger. NORMAN KERR.]

Neuralgia is the most prolific cause of morphinism. J. B. Mattison (Med. Rec., Oct. 26, '95).

According to the statistics of institutions for the treatment of opium-addiction, there is no class of invalids from which there have been more opium *habitues* recruited than chronic neuralgics. Wendell Reber (Buffalo Med. Jour., Dec., '95).

Injudicious medical prescription has had much to answer for in introducing the practice of the autoinjection of narcotics.

Case of chronic morphinism in which the drug was taken in solution by rectal injection in enormous doses, estimated about 5 pounds in ten years. Brazier (Jour. de Méd., July 19, '91).

Medical practitioners cautioned against administering opiates for the relief of pelvic pain. Hines (Maryland Med. Jour., Mar. 19, '92).

Nearly all personal cases of narcotic inebriety are to be attributed to medical prescription of the drug in the first instance. J. B. Mattison (Med. Rev., Feb. 11, '93).

The need of strict enforcement of laws governing the sale of opiates by druggists emphasized. Exposure of morphinomania by registering in an open ledger

the names of all purchasers of opium not presenting the prescription of a reputable physician, recommended. Happel (*Atlanta Med. and Surg. Jour.*, July, '95).

The opium habit cannot lay claim to great indebtedness to direct heredity, though its descent through three generations has been observed. It is, in a vast number of cases, an undoubted disease, a functional neurosis, whence arises a physical crave for a renewal of the sensation of intoxication. Thus considered, it is important to bear in mind that a considerable proportion of opiomaniacs are the subjects of neurotic inheritance. Alcoholism in parents may tend to opium excess in the children, or to some other interchangeable neurosis.

The opium habit appears most frequently in persons with a neurotic and opium diathesis, persons suffering from disturbances of nutrition, and those who are invalids or have the entailment of a previous disease or injury. Crothers (*Quarterly Jour. of Inebriety*, Apr., '92).

The offspring of the victim to the morphine habit has a condition of the nervous system such as, once subjected to some exciting cause, develops the tendency rapidly. Hoppel (*Quarterly Jour. of Inebriety*, Oct., '92).

A few of the most important causes which lead to the habitual use of opiates are: First. Inheritance. It has been proved that women who become pregnant while using opium are very likely to miscarry, but that when they go to full term the majority of the children die unless given paregoric or some other form of opium, but an inherited tendency to narcotics or stimulants is more frequent. Second. Severe pain, long continued. Third. Overwork and loss of sleep. A. J. Pressey (*Cleveland Jour. of Med.*, Jan., '99).

Though some children of opium-in-ebriates inherit a debilitated constitution consequent on parental indulgence, the proportion who are so weighted is not large compared with the proportion of

children afflicted with alcoholic heredity. Yet, in a substantial proportion of opium cases both the inebriate and neurotic inheritance has been traced, in some instances one and in other instances both forms of transmission being present. The narcomaniacal diathesis seems to occur in a dissimilar as well as in a similar form. In favoring circumstances under the influence of inebriate exciting causes, the progeny of opium-drunkards have exhibited a tendency to alcoholic excess, and the children of alcoholists to opiate intemperance.

The number of babies forced into the opium habit is appallingly large. At the Babies' Hospital in New York investigation showed that over half of the patients received under six months of age had been systematically drugged with opium in the form of paregoric or soothing syrup.

An infant may become as firmly addicted to opium as an adult, and feels as keenly its withdrawal. They acquire the habit in one of three ways: Through the mother, who does not realize the harm she is doing, but resorts to soothing syrup or some other opium preparation to obtain quiet and rest for herself; through the nursery maid or other attendant, who neither knows nor cares what the result may be so long as she is spared from trouble; through the monthly nurse, many of whom make capital upon their ability to keep a child quiet. The physician is often at fault in advising the administration of paregoric for the minor aches and pains of the infant. Editorial (*Archives of Pediatrics*, May, '99).

Case in 9-month-old child, weighing only eight or nine pounds. Six months before the mother had begun administering laudanum for colic, giving from 4 to 20 drops, aggregating from 1 to 2 drachms daily. Under the influence of the drug the infant was apparently well, but as soon as it was withdrawn there were pain and fretfulness. Gradual reduction of the dose until cessation was followed by a prompt recovery. W. F.

Boguess (Archives of Pediatrics, May, '99).

Female alcoholic inebriates, especially in England, are very common. Female opium-inebriates are rare. In China and other Eastern countries a very much larger proportion of females are victims of opium-inebriety than in Great Britain or America. In many opium-dens in those Oriental regions women form no inconsiderable ratio of the smokers.

The Burmese appear most incapable of using opium in moderation, while in China the majority are able to limit their consumption, and never increase their daily allowance.

The legitimate Chinese imports of Maliva opium, the product of Central India, alone exceeds 2000 tons. The importation of Bengal opium amounts to about 1200 tons. Hart (Brit. Med. Jour., Mar. 6, '89).

The greatest liability is between 30 and 50 years of age, the number of cases below and above that age being comparatively few.

Pathology.—The pathological changes which have been observed in opiumism are few and limited. The shrunken and withered appearance of the habitual opium-inebriate is a fair representation of his internal physical state. The repeated contraction of the vessels impairs the nutritive process. When the opium habit has become a disease it alters nutrition and perverts vital function.

Morphine in the body, by taking up oxygen, is changed into oxidimorphine, which latter gives rise to symptoms of abstinence. Use of atropine for relief is irrational and should be abandoned. Erlenmeyer (Amer. Jour. of the Med. Sciences, Apr., '94).

A striking point of difference is that there are few animals which cannot be alcoholized, while opium is innocuous to many. Elephants, horses, dogs, monkeys, and jelly-fish have been brought under the influence of alcohol.

In carefully-conducted scientific experiments representatives of the brute creation have been slain prematurely by both acute and chronic alcohol poisoning. On the other hand, pigeons live and thrive on opium.

Principal conclusions of experiments on cats for purpose of producing morphinism are as follow: (1) morphine is always, and in all doses, an excitant and convulsant to the cat; (2) this is manifested by agitation, hyperexcitability, hallucinations, and a restless drunkenness; (3) contrary to what is observed in all species of animals in which this drug is an hypnotic, the pupils are dilated, the respiration and the heart are accelerated, the chilling of the peripheral parts indicates vasoconstriction, and there is an abundant hypersecretion of saliva; (4) the employment of large doses produces an exaggeration of the symptoms mentioned, and a modification in the gait of the animal is observed,—it frisks about, and convulsive shocks follow; (5) when a dose of $\frac{3}{8}$ grain per $2\frac{1}{2}$ pounds of the animal is given, it is usually fatal to the cat, which becomes more and more excited, has violent convulsions, and dies in a state of tetanic rigidity; (6) contrary to what is observed in animals which morphine calms, the young subjects are less sensitive to it than the old ones, and in all the animals of this species in which morphine is constantly excitant it is an excellent adjuvant to anæsthetics. Guinard (Lyon Méd., Aug. 16, '91).

Organic lesions are comparatively rare. Even when premature death ends the succession of alternating states of woe and bliss which constitute the opium-inebriate's life, functional derangement, impairment of the nutritive process, nerve-exhaustion, a dried, wrinkled, cadaverous skin, general wasting and emaciation, and a bent form are prominent links in the lethal chain.

Opium may be a contributory cause of paralysis, but it does not act directly as a paralyzer.

Prognosis.—Opium transcends alcohol

in the generation of a more irreclaimable and incurable diseased condition. Cured opium-inebriates are comparatively fewer in number. It is much more difficult to abandon the opium than the alcohol habit. In China, in districts where almost the whole population indulge to excess in opium, the people are (humanly speaking) beyond the pale of moral and religious effort. The perception is so clouded that they are not amenable to intellectual and other elevating influences. Opium seems to take an even closer and more enduring hold on the human brain than does alcohol.

The morphinomaniac's only chance of recovery is to enter some hospital and put himself unreservedly into the hands of a doctor. Grellety (*Jour. of Mental Sci.*, July, '93).

In the young the prognosis of morphinism is good. Every case—unconnected with structural lesion or if nutrition be not too greatly damaged and if given proper care—can be cured. J. B. Mattison (*Archives of Ped.*, Nov., '95).

Reports received from 937 cases, showing 421 treated at sanitariums, with 63, or 15 per cent., cured; 358, or 85 per cent.; failures; of the number of cures reported 33 proved relapses. Of 560 treated at home there are 268, or 32 per cent. of cures, and 48 per cent. of failures. Editorial (*Med. Summary*, Dec., '95).

The prognosis of morphinomania is favorable, although relapses are frequent. Editorial (*Med. Rec.*; *Bull. of Pharm.*, June, '97).

Treatment.—In morphine-inebriety, in whatever form the narcotic has been taken, it is desirable to withdraw the poison as speedily as may be practicable. But the difficulty here lies in the practicability. The narcotic has been suddenly withheld, and it has been gradually tapered off. Among other distressing symptoms after sudden withdrawal, the following have been observed in an aggravated form: Rigors, nausea, vomiting,

exhaustive diarrhœa, convulsions, delirium, prostration, and collapse. Languor and sneezing are minor troubles. The agony is in many cases indescribable, and the symptoms are so alarming that the full narcotic dose of the drug has had to be given to avert a fatal issue.

The prisoners at the Ahmedabad Jail addicted to opium, whose opium was stopped, lost weight only slightly in the beginning, and ultimately gained in weight. J. Benjamin (*Der prakt. Aerzt*, Aug. 1, '93).

Six cases of morphinomania treated by sudden withdrawal of the drug with success. Comby (*Le Bull. Méd.*, June 24, '94).

Cases reported showing that sudden and complete withdrawal of the drug is not followed by deleterious results. M. V. Ball (*Med. News*, June 29, '95); M. E. Hughes (*N. Y. Med. Jour.*, Mar. 2, '95); J. M. Taylor (*N. Y. Med. Jour.*, Apr. 20, '95); Gaillard (*Revue Inter. de Méd.*, etc., Feb. 10, '95); Hodée (*Thèse de Paris*, '95); Rendu (*La Tribune Méd.*, Nov. 8, '94).

The violent diarrhœa and vomiting following sudden demorphinization are not usually harmful, being due to sudden renewal of hepatic action, and the consequent elimination of bile probably containing stored-up morphine. The flow should be allowed to continue, but under strict medical supervision, lest bulbar asphyxia ensue. Sollier (*La Semaine Méd.*, Aug. 17, '95).

Sudden method of withdrawal in healthy patients who are taking an amount of morphine exceeding 8 to 10 grains per day favored. Giles de la Tourette (*Bull. de Thér.*, Sept. 15, '95).

In hospital-practice opium or its preparations may be withdrawn at once absolutely, but in private practice this is impossible. Under the latter conditions the drug is withdrawn gradually and strychnine in large doses is given hypodermically, and equal parts of red cinchona and fluid extract of coca—1 drachm of this—are administered by the mouth. If the nervous paroxysms are marked, potassium bromide must be added. The patient should be kept in

ignorance of the amount of the opiate taken and of its final discontinuance. Robertson (Med. News, Aug. 27, '98).

The gradual method of suppressing the drug should only be employed in patients who show a marked morphine cachexia. The abrupt method may be used when a physician is at hand to administer a dose of the agent in case of serious collapse, and is suitable for cases that are not of long standing, or in which the patient is young and free from cardiac or other visceral lesions. In most cases an intermediate method, that of Erlenmeyer, is advisable: a rapid method, but not abrupt, combining the safety of the gradual method with the quickness of the other. The patient must first be put into a condition to sustain the process of demorphinization by appropriate treatment, and then each day a half of the daily dose may be cut off; when the dose has become very small the drug may be altogether discontinued. For severe cases, eight to ten days are usually sufficient; for slight cases, six to eight days. Jofroy (Gaz. Hebdom., Dec. 10, '99).

My sympathies are with the heroic course, but the sufferings undergone, with some risks (such as paralysis) consequent on the peremptory stoppage of supplies, have forced me to the conclusion that gradual diminution of the dose ought to be the rule. Especially is this procedure indicated when we are dealing with parturient *habitués* and with their offspring.

Three cases of abstinence symptoms in newborn children of opium-taking mothers, who were unable to nurse them. Kiernan (Review of Insanity and Nervous Disease, Mar., '91).

The foetus *in utero* may survive despite the fact that large doses of morphine are taken into the mother's circulation. Morphinism may be transmitted directly from mother to child *in utero*, should the foetus survive gestation.

Delivery of a morphine *habitué* who had been taking daily 5 grains of morphine hypodermically, of a well-developed child, which gradually became irritable, and fretful, and finally refused food.

One-twentieth of a grain of morphine was administered hypodermically with no other than a soothing effect. Under small doses the child has continued to grow rapidly. P. C. Layne (Cincinnati Lancet-Clinic, July 9, '98).

The writer uses the hydrobromate of hyoscine hypodermically, in doses of from $\frac{1}{200}$ to $\frac{1}{50}$ of a grain in the treatment of the morphine habit. The dose should be very small to begin with, $\frac{1}{200}$ of a grain, and increased gradually to $\frac{1}{100}$ of a grain. As morphine and strychnine are antidotes for hyoscine, no fear need be felt of producing disastrous effects. The writer has never seen any bad after-effects from its use. The plan of treatment is as follows: The patient is kept under observation for a few days, and the amount of morphine and cocaine reduced to what will keep him comfortable, although this is not necessary. The night before beginning the use of hyoscine, 6 to 8 grains of calomel, in combination with some vegetable cathartic, are given, and this is followed by a saline the next morning. The usual morning dose is given, but when the patient calls for morphine in the afternoon hyoscine is substituted, and from this time for thirty-six to forty hours the patient is kept under the influence of the drug, $\frac{1}{200}$ to $\frac{1}{100}$ grain being given every two or three hours, according to the condition of the patient, but never enough to stupefy him completely. The patient should be kept in bed and supplied with a day and night nurse, so as to keep him under constant surveillance. If the pulse becomes weak or irregular, strychnine may be given, and, if necessary, a little morphine or codeine is added. If there is need for a hypnotic the writer gives trional or chloral hydrate, with bromide of soda. Large doses of the latter, given for a few days preceding the treatment, will allay nervousness. The after-treatment is the same as in other methods—tonics, nourishing diet, and rest. J. M. Buchanan (American Journal of Insanity, Apr., 1904).

There are cases in which immediate cessation of the drug occasions com-

paratively little distress, and is successful, but these have been, so far as I have seen, exceptional. I generally spread the period of gradual diminution of the dose till entire discontinuance of the drug over four or five weeks. The length of this tapering-off process, however, depends chiefly on the daily amount of opium or morphine used, while taking the idiosyncrasy of the narcotee and the effect of the poison on the individual constitution into account. Occasionally three weeks suffice, but the duration sometimes extends over eight weeks.

The following method of treating chronic morphinism is simple, safe, and satisfactory. A mixture containing 5 grains of bromide of sodium to a drachm is ordered, and a drachm of the mixture is given every three hours; the dose is increased by a drachm every day. By the time the patient is taking the $\frac{1}{2}$ -drachm doses of bromide every three hours for a day or two he will probably be able to do without his morphine. If the drowsiness by this time is profound, the bromide may be stopped; if it is not very deep the dose can be diminished by 5 grains every day until no more is required. J. C. Verco (*Australasian Med. Gaz.*, Mar. 20, '99).

No remedy for any disease fills an indication more perfectly or gives better results than does hyoscine in the treatment of morphinism. The gradual reduction method of treating morphinism should be discarded as useless and even hurtful; the sudden withdrawal, without some agent to relieve the patient's suffering, is inhumane and dangerous. This leaves the rapid reduction as the only one of the old methods worthy of consideration, but in this the patient suffers so intensely and the result is so seldom a cure that it certainly cannot be regarded as a satisfactory or successful treatment.

The painful symptoms attendant upon the abrupt withdrawal of morphine have a natural limit of a few days' duration. By the use of hyoscine these days may be passed in comfort, and the patient

enabled to escape the nerve-strain and shock that would necessarily have attended such an ordeal of suffering. In the opinion of the author, hyoscine not only occupies, but fills, when properly used, as important a place in the treatment of morphinism as does chloroform or ether in the practice of surgery. Its office is very similar to theirs. It saves the patient from indescribable suffering and renders the unsafe, impracticable, and difficult, safe, practicable, and easy.

In a series of nearly 400 cases in which the writer has used this remedy he states that only in two or three cases has delirium or delusions of any kind been present as long as forty-eight hours after the last dose. Probably, in one case out of ten, such symptoms continue twenty-four hours after the last dose, but in fully 90 per cent. of the cases the mind was perfectly clear by the twelfth hour or earlier, and remained so thereafter. In many cases the delirium subsides by the fourth to sixth hour after the last dose. G. E. Pettey (*Medical News*, Feb. 28, 1903).

Potassium and sodium bromides are generally indicated to subdue the extreme nervous irritability, with henbane and cannabis Indica. The quantities administered must vary with the individuality of the case. Bearing this in mind, the formula appended may be taken as a guide:—

℞ Potass. bromid., gr. xx.
Sodii bromid., gr. xx.
Tr. cannabis Indic. fl., m. xv.
Tr. hyoscyami fl., m. xv.
Sp. ammon. aromat. fl., m. xx.
Tinct. cardamom. co. fl., m. xx.
Aq. destillat., ad fl. oz. iij.

When the patient can bear the immediate or almost immediate withdrawal of the drug, a much smaller dose of this mixture, repeated once or twice, will be ample. After a day or two tonic treatment can be begun.

Dionin, a hydrochlorate of morphine ethyl ether, is valuable as a substitute

for morphine. The morphine is gradually withdrawn. When the amount of morphine taken daily has been reduced to $\frac{1}{2}$ or $\frac{1}{3}$ grain, it is well to stop it altogether and substitute the dionin. One grain may be sufficient to quiet the untoward symptoms, but more may be required. The drug is quite soluble in water. A small dose given in the beginning of the restlessness will give relief, while a much larger dose may be without effect if one waits until the access becomes violent. Fromme (Berliner klin. Woch., Apr. 3, '99).

Some authorities favor the administration of heroic doses of the bromides. I do not. With daily doses of from 60 to 100 grains of potassium or sodium bromide it is easy to so daze and inco-ordinate an inebriate that he becomes utterly helpless and totally unable to help himself either to drink or anything else. The injurious after-effects which I have seen to follow such treatment have been too grave to allow me to warrant such measures. The nervous systems of some individuals have been quite shattered by bromidism, the unfortunate sufferers having become complete neurotic wrecks. (See BROMIDES, volume ii.)

The crave for opium or morphine is dependent on an abnormal physical condition, which it has been claimed that sparteine and nitroglycerin relieve. It seems to me that all the benefit derivable there lies in their potency as cardiac stimulants. For this important part of the treatment—the stimulation and bracing of the heart—digitalis and strophanthus have, in my hands, been invaluable, especially the former. Sparteine is administered hypodermically, and nitroglycerin is given in tablets or in a 1-per-cent. alcoholic solution.

In opium inebriety there is often severe and prolonged vomiting, during the earlier stages of treatment especially. When these symptoms are present I find

it advantageous to administer the bromides in something like this form, for a few days, till the night draught can be retained:—

℞ Potass. bicarbonat., gr. cxx.
Potass. bromid., gr. lx.
Sodii bromid., gr. xxx.
Tinct. cannabis Ind. fl., m. xxx.
Sp. ammon. aromat., fl. dr. j.
Tr. cardamom. co., fl. dr. j.
Aq. destillat., ad fl. oz. vj.

M. Sig.: A sixth part three times daily in effervescence with an acid powder.

℞ Acid. citric., six powders of 15 grains each.

Sig.: The acid powders.

Tinct. nucis vomicæ should often be added to the above mixture in 3- to 6-minim doses.

Ice, milk and lime-water, or milk and soda-water will aid in counteracting the vomiting.

In most cases I begin the treatment with 4 grains of blue pill, following by a black draught or Seidlitz powder next morning.

In all cases great attention should be paid to the diet, which should be nourishing, easy of digestion, and such as will not be rejected by the stomach. Peptonized milk, beef-peptonoids, broths, soups, and similar preparations are good. As soon as it can be borne, white-fish, cut up fine with a little of the juice of a lemon, is very grateful. Fresh fruits and green vegetables are refreshing, and can be retained and assimilated. Fatty foods, when these agree, are of great value in the remedying of nerve-starvation.

The toxic effects of the poison are considerably mitigated by the gratification of a robust appetite. A generous consumption of nourishing food in some

measure tends to protect the bodily organs from the poisonous influence. Unhappily the desire for, and the capacity to digest, nutritive food is generally impaired.

In certain cases the Turkish bath aids in procuring sleep as well as in soothing the nervous irritability. At other times these objects will be secured more easily and cheaply, occasionally more effectually, by the wet pack, which, however, must be carefully applied, or it will do more harm than good.

[Dip a sheet in hot or tepid water, the former being preferable. Wring the wet sheet well, and closely envelop the whole body (except the head and neck) in the sheet. Above this, leaving no part of the damp sheet uncovered, roll a blanket round the body. Then add successive wrappings of a couple or more blankets. The patient will generally be in a profuse perspiration within three-quarters of an hour. He should not be allowed to remain in the pack longer than 75 minutes, even when sleep has not been won.

The application may, in suitable cases, be repeated daily, or even every second or third day according to circumstances. To avoid any possible risk, the pack should be applied not less than two hours, or more than three hours, after food. I have seen an excellent calmative influence exerted on the opiumist by this simple and agreeable procedure. Whenever sedative soporific can be employed, in all forms of inebriety I prefer it to the exhibition of large doses of narcotic drugs for the purpose of securing sleep. NORMAN KERR.]

I pursue a similar course of treatment in morphine injection, the dose being steadily diminished day by day, with a weekly full narcotic dose of opium with belladonna, or chloral with bromides at night, instead of that day's reduced hypodermic dose.

Profession urged to substitute codeine for morphine whenever practicable. Mat-

tison (Med. and Surg. Reporter, Oct., '91).

Heroin is an excellent substitute for morphine in morphinism. In cases taking 12 grains of the former a day, 2 grains of heroin hydrochloride act as a substitute. Increasing doses of strychnine and cannabis Indica, beginning with $\frac{1}{30}$ grain of strychnine and increasing the dose up to tolerance. The tolerance to the latter found remarkable in some cases, giving sometimes as high as a grain a day of strychnine. The craving for the drug was relieved, and at the same time the patients were free from pain. M. B. Ahlborn (N. Y. Med. Jour., Aug. 3, 1901).

I never allow opium- or morphine-inebriates any alcoholic intoxicant beverage. There is danger of alcohol- or chloral-inebriety being added to the opium habit.

Insurance and Morphinism.—Though opiomania and morphinomania are more difficult of cure than alcoholomania, pathological science has not as yet revealed any post-mortem appearances indicative of the grave organic degeneration and permanent structural alteration seen in the bodies of intemperate alcohol-takers. The particulars of some twenty-five cases afterward collected and published by Christison made known records of forty years' career of opiumism without any apparent physical hurt. It is true that there are recorded instances of long life in the person of excessive consumers of alcoholic intoxicants, but these are regarded as exceptions to the general rule that alcoholic intemperance shortens life.

Yet there can hardly be a doubt, in the opinion of the overwhelming majority of medical observers, that continuous excessive opium-consumption is subversive of good health, and therefore likely to induce premature decay. Decay following disturbance of function is the prominent feature of the opiumist's slow march to the

grave. Some recent medical authorities, such as Sir William Moore and Dr. Farquharson have denied that opium-eating leads to premature death; and, in candor, I am bound to admit that I have not seen sufficient evidence to demonstrate those structural kidney changes which Dr. Mattison ("Opium-addiction as Related to Life-insurance," *The Doctor*, Dec., '90, New York) seems inclined to believe result from the immoderate use of opium. In opiumists and morphinomaniacs I have seen albuminuria present in less than 1 per cent. of my cases.

Mattison is of the opinion that, in striking contrast to the prevalence of transmission in the genesis of alcoholic inebriety, heredity plays but an insignificant part in the causation of opium-indebriety. I agree with this opinion in the main, if homogeneous or simple inheritance is meant, but disagree if transformed heredity be included. In my experience, a large proportion of those persons who "take to opium," and every variety of inebriants, inherit either the inebriate diathesis or some germane neurosis which is transformed into opium, chloral, or other intemperance in the descendant.

Dr. Mattison obtained from the medical officers of a number of large American insurance-offices the course pursued with proposals of insurance on the life of ex-opiumists. He found that the rule was to refuse, and demand a probation of from three to ten years, though some offices would not insure such lives on any terms. On the whole, giving due consideration to all the probabilities and risks, I would suggest that one and a half years of probation be required after one year's indulgence, three for two years; and thereafter six months for every two years of additional addiction ought to qualify for the acceptance of a life in other respects

eligible for insurance. I would add the additional condition that the applicant be not above forty-five years of age on this probation.

NORMAN KERR,
London.

MORVAN'S DISEASE. See SPINAL CORD.

MOUNTAIN-FEVER. See SPECIFIC INFECTIOUS FEVERS.

MOUNTAIN-SICKNESS.

Definition.—This term is given to a series of symptoms resulting from diminution of the atmospheric pressure when high altitudes are reached. Though termed "mountain" sickness, it might also be called "balloon" sickness, since it also presents itself when high elevations are attained during aërial navigation.

Symptoms.—According to von Liebig, it affects persons unaccustomed to mountains at a height of 10,000 feet and upward. The symptoms are quick pulse, rapid breathing, and feelings of constriction and weariness; in higher degree, giddiness, nausea, loss of strength in the legs, finally engorgement of the venous system and the escape of blood from the superficial capillaries. The same symptoms may be caused, at lower levels, by violent exertion, but when they appear at higher altitudes without any or with very slight exertion, they are due to the rarefaction of the air. The expirations are unconsciously quickened under a lower atmospheric pressure; whereas, the greater pressure at lower levels affords greater resistance to the expired air, and thus makes the respiration slower.

The temperature is slightly raised—seldom over two or three degrees. When very high altitudes are reached, hæmorrhages from the nose, mouth, and ears occur.

Pathology.—The increased frequency of respiration at higher levels is involuntary, and the respirations become more shallow to compensate for it; hence the lungs become more contracted, and they accommodate less blood. Venous stasis and deficient oxidization ensue. Though less oxygen reaches the lungs when rarefied air is breathed, causing increased distress, this is not the main cause of the disorder. A person must be accustomed to the atmosphere of higher levels before a normal respiration occurs under the altered condition of atmospheric pressure.

MOUTH AND LIPS, DISEASES OF THE.

Catarrhal Stomatitis.

Definition.—An acute inflammation of the mucous membrane of the mouth usually caused by local irritation or occurring in the course of exanthematous diseases or prolonged febrile disorders.

Symptoms.—Although the entire buccal membrane may be involved,—that of the tongue, lips, and cheeks,—the labio-gingival region is usually the seat of the most active inflammatory manifestations. Redness, heat, tumefaction, furring of the tongue, and local discomfort constitute the symptoms witnessed in light cases; but in some, and particularly in infants, there is severe pain, sufficient, indeed, in the majority of cases to prevent nursing. Local pain also attends a form of stomatitis observed in nursing women. In severe cases of catarrhal stomatitis the tongue appears enlarged and the lingual papillæ project prominently. The saliva is greatly increased in quantity and is often sufficiently acrid to excoriate the lips and chin. Minute areas of the epithelial covering often become transformed into small, shallow, pultaceous, and quite painful ulcers.

which are especially sensitive when touched or brought into contact with other mucous surfaces during mastication. Slight fever is sometimes present even in the condition occurring independently of infectious febrile disorders, of which catarrhal stomatitis is a frequent complication. The symptoms usually last from four to ten days.

In some instances the oral mucous membrane is dry, the inflammation manifesting itself by the presence of heat, pain, and redness. This constitutes the “erythematous catarrhal stomatitis” of certain authors.

Etiology and Pathology.—Catarrhal stomatitis may be primary or secondary. In the primary form the causative factor is a local irritant,—mechanical, chemical, or thermal,—which gives rise to excessive desquamation of the epithelium. Undue acidity of the oral secretions, unduly hot or cold foods, tobacco, strong condiments, fermenting or decomposing particles of food through insufficient cleansing of the mouth and teeth, etc., may give rise to the affection. In the secondary form the oral inflammation is symptomatic and often attends infectious diseases,—measles, typhoid fever, —and other exanthemata, and the prolonged fevers. It may also arise through continuity of tissue or by infection, owing to the presence in neighboring structure of an acute inflammatory disorder, such as tonsillitis, gingivitis, pyorrhœa alveolaris, etc. Gastric disorders are frequently complicated with catarrhal stomatitis. This oral disease may also occur as an evidence of general depravity of the organism, the result of unhygienic surroundings and poor food.

In the true catarrhal form thickening and softening of the mucous membrane is the most evident pathological feature: epithelial erosions covered with pulta-

ceous masses of cells undergoing retrograde metamorphosis being observed in various spots in marked cases. The saliva is usually acid in reaction.

Treatment.—The internal administration of chlorate of potassium, frequently resorted to, is a pernicious practice in this form of stomatitis, owing to its evil influence upon the kidneys. Employed in saturated solution (about 1 drachm to the pint) as a mouth-wash, however, it is exceedingly useful. In many cases, borax, 10 grains to the ounce, is more effective, employed frequently during the day every half-hour and with especial care after eating. In infants the mouth should be gently cleansed after each feeding and a preparation of boric acid, 15 grains to the ounce of rose-water, applied with a swab, or, better, on a square piece of soft linen over the finger of the nurse. When mastication is difficult or very painful, the local application of a 4-per-cent. solution of cocaine to the sensitive spots affords great relief and enables the patient to eat comfortably. When the shallow ulcers resist less active measures they should be lightly touched with blue-stone or a weak solution of some of the silver salts, preferably the nitrate.

[In catarrhal stomatitis perfect cleanliness of mouth and nipples is of the utmost importance. The mouth should be cleansed after each feeding by cotton wrapped upon a small rod, or by inducing the child to suck ice-water from a piece of soft linen. Food, as far as possible, should be given cold, but the child should not be taken from the breast. Chlorate of potassium is useless and often harmful.

If the disease persist, the mouth should be penciled with a $\frac{1}{2}$ -per-cent. solution of nitrate of silver daily, and cracks or ulcerations should be touched with the mitigated stick. L. EMMETT HOLT, Assoc. Ed., Annual, '90.]

In stomatitis ulcers may be touched

with a tiny piece of absorbent cotton, which has been dipped in the following solution:—

℞ Borax, 45 grains.
Salicylate of sodium, 75 grains.
Tincture of myrrh, 1 drachm.
Syrup and water, of each, $\frac{1}{2}$ ounce.

The child should also take milk which has been boiled or sterilized. In ordinary erythematous stomatitis the child's mouth should be washed out, particularly after each meal, with this solution:—

℞ Borax, 30 grains.
Bicarbonate of sodium, 1 drachm.
Distilled water, 4 ounces.

Morain (Jour. des Prat., Aug. 15, '96).

Aphthous Stomatitis.

Symptoms.—In this variety of stomatitis there appear, besides the more or less marked inflammation of the oral mucosa, small, elevated, round or oval vesicles two to five millimetres wide, and surrounded by a red areola, which, as early as twenty-four hours after their appearance, form shallow, yellowish-white spots of ulceration, with bright-red margins. They may appear singly or in groups in any part of the mouth, but they are apt to appear in greatest number on the labial mucous membrane, along the external portion of the gums, inside the cheeks, and along the edges of the tongue. They are much more painful than those observed in the catarrhal form, and render nursing or the taking of food very difficult. The aphthæ sometimes extend to the fauces.

The general symptoms are somewhat more marked than in the previous form. Slight fever, anorexia, furring of the tongue, and heavy breath represent, however, about all the manifestations usually witnessed. Although there is an increased flow of saliva, the latter is never foetid (Holt). The pain attending the presence of the ulcers especially renders the child cross and fretful when food is

taken, but the active nervous manifestations of the more severe forms are absent. In the form observed in connection with febrile diseases the general symptoms are obviously those of the causative affection. Aphthous stomatitis tends to recur when the primary general cause is not completely removed.

Etiology and Pathology.—Aphthous stomatitis is usually observed in children under three years old. It is a frequent complication of gastro-intestinal disorders and is often seen in debilitated or poorly-fed subjects. It is most frequently met with in conjunction with, or as a sequel of, some febrile diseases, especially the acute exanthemata.

Local outbreaks of aphthous stomatitis have been traced to milk of cattle infected with foot-and-mouth disease (Ollivier), but the claim of Siegel that the cause of the disease in man and the lower animals is the same has not as yet been accepted.

No parasite special to the affection has as yet been isolated.

Treatment.—The treatment of this condition does not differ from that previously described. Holt states that each ulceration may be touched with nitrate of silver, but that no other active measures should be employed. The disease tends to spontaneous recovery in from seven to fourteen days. Goppert has recently (*Jahrb. f. Kinderh.*, Jan., '99) recommended orthoform as a local anæsthetic, the powder being simply blown over the diseased areas, after cleansing the whole oral cavity. Food should only be used fifteen minutes after each application. Marfan resorts to frequent washing of mouth with a saturated boric acid or a 1 to 500 solution of carbolic acid. To the ulcers he applies a 5-per-cent. solution of nitrate of silver, a 1 to 500 solution of permanganate of potas-

sium, or a solution of iodine and iodide of potassium in glycerin and water.

The following preparation is much employed by French clinicians:—

℞ Borax, 4 parts.
Tincture of benzoin, 2 parts.
Distilled water, 10 parts.
Syrup, 20 parts.

M. To be applied five or six times a day.

Diphtheria antitoxin tried in the treatment of an infant one year old, affected with a grave aphthous stomatitis which had produced a marked cachexia. The injection was promptly followed by a sensible amelioration in the general state, while at the same time the sublingual swelling, which had been unaffected by lotions of permanganate of potash and nitrate of silver, rapidly disappeared. Del Monaco (*Revue Men. des Mal. de l'Enfance*, Aug., 1903).

Ulcerative Stomatitis (Fœtid Stomatitis; Putrid Sore Mouth).

Definition.—Inflammation of the mucous membrane of the mouth and underlying structures attended by the formation of a deep ulcer which usually develops in the gum about the lower incisors. It only occurs when there are teeth (Forchheimer).

Symptoms.—Ulcerative stomatitis generally develops near the edge of the gum immediately above the labio-gingival sulcus. The area affected is at first red and tumefied and very sensitive. A deep, pus-secreting ulcer having a red areola, surrounded, in turn, by a zone of œdema, is soon developed. In some cases this ulcer reaches down to the periosteum, and is followed by necrosis of the alveolar process. The gingival mucous membrane becomes softened and spongy and the teeth are loosened. Although the inflammatory process may invade all

the tissues of the mouth, the ulceration rarely extends beyond the anterior portion of the gums. Occasionally the membrane of the cheek opposite the ulcerated area also ulcerates. The breath becomes intensely foul, and slight gingival hæmorrhages cause the profuse saliva secreted to appear bloody. Severe pain is experienced during mastication. There is swelling and pitting of the tongue and enlargement of the submaxillary glands. Vomiting, diarrhoea, and marked fever are usually present, and an exanthematous eruption resembling that of measles is occasionally observed. In children the disease sometimes culminates fatally, especially when unhygienic environments and unwholesome food cannot be replaced by improved conditions, the disease being one denoting a depraved state of the general organism.

Etiology and Pathology.—That a specific micro-organism must exist is emphasized by the occasional prevalence of ulcerative stomatitis as an epidemic disease in institutions, barracks, camps, and prisons, especially when the sanitary conditions are defective and where poor food is supplied. Squalor in all its forms tends to promote its appearance, cold, damp, and defective ventilation being among the many predisposing elements. Insufficient care of the mouth, especially when tartar is allowed to accumulate around the teeth, carious teeth, or decaying roots, infectious diseases, congenital heart affections (Duckworth), scurvy, saturation of the system with lead or phosphorus are among the most frequent etiological factors known.

In a series of 30 cases recently examined by Bernheim and Popischill (Wiener klin. Woch., No. 27, '97) two micro-organisms were found in the ulcers in all the cases, a bacillus and spirochæte, both being mobile. Attempts to

cultivate them failed. Besides these organisms, which were always present, there were usually also streptococci and staphylococci in addition to the organisms generally found in carious teeth: *leptothrix buccalis*. The specific organism of ulcerative stomatitis may still be considered as unknown, however.

Treatment.—In this affection chlorate of potassium may be given internally, 2 to 5 grains three times a day to a child, and also applied locally in the form of a mouth-wash, the saturated solution being employed. This constitutes a truly specific treatment, the disease being thus readily controlled.

[In stomatitis ulcerosa chlorate of potash is almost a specific. It is best administered in a 3-per-cent. solution with a little syrup, $\frac{1}{2}$ to 1 teaspoonful being given every two hours. Its toxic effects, if used in too large quantities, should not be forgotten. It usually produces considerable pain, but this soon ceases, and is a positive index of the curative effect of the drug. In obstinate cases the application of a solution of nitrate of silver may hasten recovery. L. EMMETT HOLT, Assoc. Ed., Annual, '90.]

A 1-grain-to-the-ounce solution of permanganate of potassium is sometimes required to counteract the foul breath, and the nitrate-of-silver stick applied to the edges of the ulcers hastens recovery. Peroxide of hydrogen, 1 drachm to the ounce, is preferred by some clinicians as a mouth-wash. Care should be taken to preserve teeth that are loosened by special attention to the surrounding gums; the latter should, besides being kept scrupulously clean, be occasionally painted with a 20-grain-to-the-ounce solution of alum. Pieces of necrosed bone occasionally keep up the ulcerative process. The cavity from which the pus oozes should be carefully probed and surgical removal resorted to if needed.

A tonic treatment should be instituted. The syrup of iodide of iron is especially valuable; codliver-oil is preferable in poorly-nourished children. Hygienic surroundings and wholesome food should be insured.

Best treatment of stomatitis ulcerosa consists in gargling the mouth with a solution of chlorate or permanganate of potassium before and after meals, and in inserting afterward an iodoform-, boric-, or salicylic- gauze compress between the cheek and gums on the diseased side. This compress is removed before partaking of a repast, and renewed afterward, care being taken always to use the gargle before inserting the gauze. Orak-hovatz (Provincial Med. Jour., June 1, '94).

Parasitic Stomatitis (Stomatitis Mycose; Thrush; Sprue; Muguet; Soor).

Definition.—A disease characterized by the formation upon the mucous membrane of the mouth of pearly-white spots or flakes which gradually increase in size and spread to adjoining structures and organs.

Symptoms.—This form of stomatitis usually begins upon the tongue, and, spreading in every direction, may gradually involve the lips, the cheeks, the palate, the gums, the tonsils, the pharynx, the larynx, and even the gastrointestinal tract down to the ileo-cæcal valve (Parrot). The superficial lesion appears as small, grayish-white spots, surrounded by a zone of blood-vessels. These soon become elevated, increase in size, and often coalesce to form a false membrane; this, in some instances, has a characteristic filmy, or lace-like, look; in others it simulates a thick, friable pseudomembrane (Holt). These areas or flakes may readily be brushed off, leaving no appreciable mark upon the surface from which they were removed. Sometimes the flakes appear yellowish or brown, and the seat of implantation

bleeds, shallow erosions being then perceptible. The constitutional symptoms are less marked than in the other forms, the local manifestations being comparatively benign. Indeed, dryness of the mouth and local heat, difficult nursing or feeding owing to more or less great tumefaction and stiffness of the mucous structures represent about all the discomfort complained of. Still, the disease is a stubborn one and the lesions may persist for months. A fatal issue is occasionally witnessed in debilitated children.

Epidemic of stomatitis in the Maternity Hospital of Blackwell's Island, beginning at birth or soon after.

The pearls constituting this form of stomatitis were small, white, globular tumors, varying in size from a pin-head to a millet-seed, and numbered from one to five in each case. They were hard upon the outside and soft within. They were imbedded in the mucous membrane, and were usually covered with condensed subepithelial connective tissue, which merged into the surrounding tissue without any distinct line of demarkation. They were composed of epithelial cells, like those of the mucous membrane of the mouth. Garrigues (Med. News, Oct. 1, '92).

Symptoms of sprue are nearly always found in the presence of other well-known lesions discoverable by modern clinical methods. Careful study of these cases fails to indicate an additional etiological factor, and with our present knowledge the writer believes that sprue is a symptom-complex comparable to the typhoid state, occurring in the tropics in chronic diseases, especially those affecting the gastro-intestinal canal. W. E. Musgrave (Amer. Medicine, March 15, 1902).

Etiology and Pathology.—The primary factor in the development of parasitic stomatitis is an abnormal condition of the oral mucous membrane, the *Saccharomyces albicans*: long branching mycelium filaments requiring an acid

medium and at no time developing upon the normal mucosa. Such a condition may be especially brought about in infants by unclean feeding-bottles when impaired general nutrition co-exists. Sweets, fermenting bits of acid food, and uncleanness of the mouth may act as exciting causes by acidifying the normal secretions: a condition which the growth of mycelium intensifies. The transmission of the thrush-spores by means of feeding-utensils, spoons, cups, feeding-bottles, etc., accounts for the epidemics occasionally observed.

The predisposing factors are mainly those which tend to lower the general vital tone: the exanthemata, hereditary syphilis, etc.; but it may also appear in apparently robust children. Parasitic stomatitis is likewise met with in adults as a complication or sequel of infectious fevers and diathetic diseases: cancer, tuberculosis, etc.

The fungus develops among the epithelial cells and acini of the mucosa, forming a dense net-work. It may readily be recognized microscopically if the diagnosis be at all doubtful.

Treatment.—Prophylactic measures are first in order, the causative factors being eliminated as far as possible. Cleanliness of the mouth and of all utensils used and sterilization of feeding-bottles and all other feeding-implements are imperative, to prevent reinfection each time these are used. This should be done gently, but thoroughly, four or five times a day. The next step is to counteract the acidity of the oral secretions by the frequent use of alkaline washes and beverages. Borax, 20 grains to the ounce; sulphite of soda, 60 grains to the ounce; a saturated solution of chlorate of potassium, or pure lime-water are useful as mouth-washes. In some cases, especially where fœtor of the

breath is present, a 1-grain-to-the-ounce solution of permanganate of potassium is more effective. The atomizer may be used when the patient is too young to handle swabs or rinse his mouth. These measures should be repeated every hour.

To alkalinize the beverages, lime-water may be added to the milk, in the case of infants, in the proportion of 1 to 4.

Sugar and sweets, starchy food, and all syrupy excipients when remedies are prescribed should be avoided. The systemic state requires careful attention; indeed, thrush sometimes persists, notwithstanding all local measures, until a change of air, good food, and tonics have greatly improved the general health. Minute—*i.e.*, tonic—doses of calomel or bichloride of mercury are valuable in this connection.

Gangrenous Stomatitis (Noma; Cancrum Oris; Wangenbrand).

Definition.—A disease usually observed in children, from two to five years old, in which a gangrenous process begins on the gums or inner side of the cheek and spreads with rapidity.

Symptoms.—Gangrenous stomatitis begins almost always during convalescence from an acute febrile process in unusually debilitated children, the first lesion being a small nodule, dense and sensitive, appearing on the gum or the cheek. The skin and the neighboring mucous surface becomes rapidly hard and swelled or there is œdema. There may be pain, but, as a rule, little discomfort. In mild cases the primary ulceration may be limited to one of the starting-points and finally heal under local treatment, leaving the parts deformed and the patient disfigured if penetration of the cheek has occurred; but in the vast majority of instances the necrotic process rapidly extends, the cheek is per-

forated, and the chin, the tongue, the jaws, and remote structures—such as the eyelids and ears—are involved in the destructive process.

Violent systemic manifestations are present. There is marked fever and practically intractable diarrhoea, the breath becomes intensely foul, and the submaxillary and cervical glands are more or less enlarged. The prostration soon becomes alarming and all the evidences of fatal marasmus appear. The disease is usually fatal in from one to two weeks, but the patients are often carried off by affections that appear as complications: aspiration pneumonia, pulmonary gangrene, enterocolitis, endocarditis, etc. In short, the phenomena are those of a violent septicæmia.

Etiology and Pathology.—The affection occurs in poorly-fed children, especially girls living in damp, filthy quarters, and children recovering from various infectious diseases, especially measles, scarlatina, diphtheria, and typhoid fever. It is essentially a disease originating primarily in lowered vitality, and is not observed in vigorous healthy children.

The complications observed are usually ascribed to metastatic infiltration of the distant structures involved, except in the case of pneumonia, which is due to aspiration of gangrenous matter, and enterocolitis, due to the ingestion of gangrenous *detritus*. A bacillus resembling that of diphtheria has been isolated by Bishop, Ryan, and Schimmelbusch; Babès and Zambilovici have also isolated a pathogenic organism capable of producing gangrene resembling noma in rabbits; but all these observations require further investigation.

Bacteriological examination in two cases of noma. In the first case bacilli and cocci were found, the former being very numerous in the necrosed portions

and penetrating but little into the neighboring parts, while the cocci had penetrated deeply into the lymphatics of the surrounding healthy parts. Cultures yielded a liquefying staphylococcus and but a single bacillus, staining by Gram's method and resembling the bacillus of diphtheria. Neither of these organisms proved pathogenic to guinea-pigs. In the second case a bacillus exactly resembling that in the first case was found. This bacillus differs markedly from the bacillus of noma as described by Schimmelbusch. Lyder Nicolaysen (Norsk Mag. f. Laegevid., p. 137, '96).

Treatment.—Prophylactic measures are also of primary importance in this form of stomatitis. The child's diet should at once be changed to one calculated to increase general nutrition. Nux vomica and gentian, combined, and in small doses, or strychnine are advantageous to promote appetite. Strong beef-juices, peptonized milk, or koumiss should be given every two hours.

The local treatment consists in the destruction of the sphacelous areas by caustics after thorough cleansing. For the latter purpose a 1-grain solution of permanganate of potassium is very useful, but peroxide-of-hydrogen, bichloride-of-mercury, or carbolic-acid solutions are preferred by some. These may be applied with an atomizer giving a coarse spray. The sloughs must be thoroughly removed and the bottom of the ulcer fully exposed. This being accomplished, a 10-per-cent. solution of cocaine is applied to the wound, and after four or five minutes the latter is touched with pure lactic acid by means of a small cotton pledget wrapped around the end of a thin probe (Sajous). Every part of the cavity must be cauterized. This is to be repeated daily until signs of resolution appear. Nitric acid, galvanocautery, and the Paquelin cautery have also been recommended, but

their use is more difficult. Excision, under anæsthesia, is a safe and useful procedure. Bromoform or bismuth subnitrate are valuable to enhance the curative process when dusted on the cauterized ulcers. Scrupulous cleanliness of the mouth is imperative.

MERCURIAL STOMATITIS. (See MERCURY, volume iv.)

Anomalous Forms of Stomatitis.

Membranous, or Croupous, Stomatitis.

—True croupous stomatitis is always a complication of croupous angina, the membrane developing simultaneously with that of the tonsils. Diphtheritic stomatitis is rarely primary, but a complication of diphtheria of the fauces (Holt).

Attention drawn to importance of diagnosing diphtheritic noma early, with a view to its treatment by antidiphtheritic serum. Though the casual relation of the bacilli to the disease is not actually proved, it is believed to be a not uncommon occurrence. Freymuth and Petruschky (*Deut. med. Woch.*, Sept. 22, '98).

Two cases of primary diphtheritic stomatitis, one in a man aged 35 years, the other in a girl aged 15. Of 400 cases personally examined, in only 2 was the membrane stated to be in the mouth. As various microbes are present, it is impossible to differentiate stomatitis due to the diphtheria bacillus by mere inspection. Bacteriological examination is therefore imperative. E. F. Trevelyan (*Brit. Med. Jour.*, Apr. 14, 1900).

Diphtheria bacilli found in all of eight cases of noma examined bacteriologically. Only one of these cases gave a pure culture of the diphtheria bacillus, and this occurred in a case with associated pharyngeal diphtheria, the child subsequently recovering. Another developed noma during measles, having suffered from diphtheria four months previously, and at the time of development of measles being isolated with another child who also presented clinical symptoms of diphtheria, but with negative cultures as regards this organism.

Three of the other cases began just after measles. Four of the eight cases began with an ulcerative stomatitis. Fifteen other cases of ulcerative stomatitis were examined in hope of finding diphtheria bacilli, but with negative results. Since noma is a species of moist gangrene, requiring probably, from analogy, two different organisms,—one a saprophyte, to produce the putrefaction; another a parasite, to produce the primary necrosis,—it is possible that in the cases in which diphtheria bacilli are found they may be the primary causative agent; and, secondly, that when other pathogenic micro-organisms capable of producing necrosis are found it is possible that they may be the primary excitants. Joseph Walsh (*Proceedings Phila. Path. Soc.*, June, 1901).

What is often called "membranous stomatitis," however, is but an aggravated form of aphthous stomatitis. The local inflammation is more intense, the aphthæ assume a development suggesting the presence of a diphtheritic pseudomembrane, while the ulcer, when the latter is removed, is deeper and larger. It is mainly observed in infants suffering from inherited syphilis or gonorrhœal infection. In the adult it is occasionally caused by the local use of strong caustics. The treatment does not differ from that of aphthous stomatitis, care being taken, however, to remove as far as possible the causative disorder.

Foot-and-mouth disease, or aphthous fever, an affection observed in cattle, is occasionally witnessed in the human being, particularly in children, the toxic element being transmitted through contaminated milk, cheese, or butter. There is marked fever and gastrointestinal and bronchial irritation; a vesicular eruption appears upon the lips, mouth, and pharynx early in the history of the disease. The tendency to hæmorrhage is greater than in ulcerative pharyngitis. The mortality in a recent epi-

demic studied by Siegel was 8 per cent. The treatment indicated is that recommended in the ulcerative form.

Official returns of Zurich and district show that an increased mortality occurred among children during the first year of life in districts where foot and mouth diseases were prevalent. The effect of the epizootic on the cattle caused a temporary reduction in the amount of milk distributed; on the other hand, on the resumption of the supply after the manifestations of disease had disappeared from the cattle, the milk was still of such quality as to be very detrimental, so that the mortality among the children occurred a few months later than the height of the epizootic disease. Oscar Wyss (*Correspondenz-Blatt f. Schweizer Aerzte*, vol. xxxiii, p. 706, 1903).

Bednar's Aphthæ.—This is characterized by the presence, over the hard palate near the gums of infants, of white patches, or aphthæ, which sometimes overlie deep ulcers. It is usually ascribed to the use of artificial nipples or to traumatism, such as that produced when the mouth is roughly cleansed by the nurse. This form of stomatitis is overcome with difficulty. A shorter and softer nipple should be ordered when this cause is apparent and the measures indicated in ulcerative stomatitis resorted to.

Riga's disease has been observed almost exclusively in the southern provinces of Italy, where it seems to be endemic, occasionally attacking all the children in a family, whether the parents be healthy or not. It is observed: when the first teeth make their appearance, apart from whooping-cough, sometimes in children whose general health shows nothing wrong, sometimes in cachectic children who are exhausted by ordinary attacks of gastro-intestinal catarrh. It begins as an ulceration under the tongue, close to the frænum. It is about the size

of a flaxseed, and gradually enlarges to the size of a sixpence. It is gray in color and painless. The border is irregular and not sharply marked, and extends somewhat over the sound tissue. It may cause death, or, after a long time, recovery may take place. The children waste in flesh, their skin becoming of an earthy hue. Enlargement of the liver and spleen occur. There is no fever. Beginning at the age of three or four months, it frequently lasts until the twentieth month. It is mostly hereditary, and only seldom do the children of such families live, unless nursed at the breast of a healthy woman.

Judging from results of histological examination, Riga's disease is a local lesion: a sort of traumatic ulceration directly connected with the rubbing of the inferior surface of the tongue on the sharp edges of the two lower incisors, the repeated friction being considered as the probable cause of the papillary appearance of the ulceration. F. Brun (*Annual*, '96).

Parrot's Disease.—This disorder is observed in the newborn and is characterized by the presence on both sides of the middle line of the hard palate of symmetrically-disposed ulcers which tend to increase in size. The ulceration often penetrates the underlying soft tissues to the bone, causing necrosis. It is a stubborn affection and requires the active measures advocated under ulcerative stomatitis.

Herpes zoster, or zona, of the mouth as described by Hugenschmidt, is an inflammatory affection of one part and only one side of the buccal cavity, characterized by an eruption of herpetic vesicles, disposed in groups according to a regular direction. The eruption is preceded and accompanied by a neuralgic pain of the whole fifth nerve. The evolution of the disease may be divided into two periods: (1) the period of invasion;

(2) the period of eruption. 1. Period of invasion begins by a rise of the temperature; there is fever; then headache, nausea, loss of appetite, etc.; intense neuralgia of the whole region of the fifth nerve. Fever lasts three days, and is followed by the period of eruption. 2. In period of eruption parts to be involved become excessively painful to the touch; mucous membrane is red and presents a series of little herpetic vesicles, disposed in groups and having size of a pin's head; some of them are united. They assume a regular direction: usually the course of the nerve. No vesicles are to be found disseminated in the mouth. The neuralgia, which is general for the first three days, localizes itself as soon as the eruption occurs.

Very similar is a disorder described by Jacobi, also characterized by an herpetic eruption, and observed in neurotic subjects. In some cases it accompanies erythema multiforme. The treatment indicated is that of the general disorder.

[Herpes zoster involving the mouth, pharynx, larynx, and especially the epiglottis has occasionally been observed and described—one case by me (Phila. Med. Jour., '98) and one by Joseph S. Gibb (Phila. Polyclinic) and others. These cases were accompanied by generalized zona. J. MADISON TAYLOR.]

Case of stomatitis which followed the administration of antipyrine. The man was suffering from rheumatic neuralgia and was given antipyrine in mixture. On the next day three or four patches of superficial stomatitis appeared on the buccal mucous membrane and two or three on the hard palate. No erythematous rash appeared. Only forty grains of the drug was given. C. K. Martyn (Brit. Med. Jour., Sept. 17, '98).

Lips, Diseases of.

Inflammation, Cracks, and Fissures.

Inflammation frequently occurs independently of oral or general affections as a result of cold during the winter

months. When the slight vascular turgescence present is complicated with cracks or fissures, considerable discomfort results. Of diagnostic importance, however, is the fact that fissures, which are usually situated in the middle of the lips, often betoken a strumous diathesis; enlarged cervical glands are usually present in such cases, however. Again, cracks at the angles of the mouth suggest the possibility of general syphilis; the surrounding tissues in that case often appear soddened, while the fissure is apt to contain pus. Labial fissures are also often witnessed in women who, in threading a needle, first bite the thread and drag it between the lips before passing the tip through the eye (Jamieson).

Treatment.—Uncomplicated congestion of the lips soon yields to mild astringents or to a preparation such as the following, in which a resinoid substance is contained:—

R Tinct. of benzoin, $\frac{1}{2}$ ounce.

Glycerin, $\frac{1}{2}$ ounce.

Rose-water, enough to make 4 ounces.

When slight fissures or cracks are present, rose-water ointment or 10 grains of salicylic acid to the ounce of cold cream usually bring about prompt resolution. Fissures often resist all simple measures, and require the application of solid nitrate of silver. In children persistent fissures leave deep furrows, and are apt to produce slight deformities. They should therefore be scraped with the curette under local anæsthesia, and the edges of the wound be drawn together and held in position by means of court-plaster until healed.

In tabulation of ninety-eight cases of extragenital chancre, it is found that the lips are by far the most common seat of these lesions. Neumann (Inter. klin. Rund., Apr. 10, '92).

HERPES LABIALIS (FEVER-BLISTER).
See **HERPES FACIALIS**, vol. iii.

Tumors of the Lips.

Of all primary neoplasms, about 3 per cent. originate in the lips; but these structures show a higher percentage when cancer is alone considered: *i.e.*, about 5 per cent. As compared to other forms of tumor observed in this region,—papilloma, sarcoma, angioma, fibroma, and cystoma,—cancer is observed in 99 per cent.

Carcinoma.

This variety of growth almost exclusively develops in the lower lip. Of 352 cases analyzed by W. R. Williams (*Brit. Med. Jour.*, Apr. 11, '92), 340 originated from the lower lip. Of 1193 instances recently studied by Fricke (*Deut. Zeit. f. Chir.; Ther. Gaz.*, May 15, '99), the upper lip was affected in but 63 instances. The predilection of this situation for the development of cancer as regards sexes is as striking. In the series of cases just mentioned 94 per cent. occurred in males. It is essentially a disease of adult and advanced life, the average being about 60 years; but carcinoma has been observed long before the fortieth year: the limit usually accepted. Fricke's list ranged from 24 to 83 years. A large proportion of the cases were in laborers and farmers, and heredity seemed to play a minor rôle. Pipe-smoking appeared to be an important predisposing factor, wounds and abrasions coming next in order.

Symptoms.—A labial cancer may begin as a mere excoriation, fissure, or ulcer, that will not heal; a small tubercle covered by a thick scab that recurs as soon as picked off; or as a warty growth. The ulceration gradually spreads and deepens, the surrounding tissues being infiltrated and hard. In many cases the carcinoma begins as an ulcerating in-

duration. The ulcer gradually assumes the typical appearance of an epitheliomatous growth, with an irregular sloughing base and abrupt everted edges. When irritated by the injudicious use of caustics or "specifics," it tends to fungate and its growth becomes more rapid. At this stage it usually becomes quite painful, and nutrition soon suffers through the inability of the patient to take sufficient food, and a state of marasmus soon becomes evident, owing to repeated hæmorrhages, the ingestion of cancerous *detritus*, etc. General toxæmia is by this time fully demonstrated by the patient's facies, and he sinks with increasing rapidity until death relieves him of his suffering. As a rule, the development is very gradual, and the glands of the jaws are not involved early. Enlargement of these glands and even their induration does not necessarily imply carcinomatous infiltration. Glands examined immediately after removal have been found free of malignant degeneration (Fricke); but there is no doubt that such glands constitute foci for carcinomatous changes and that they should be removed whenever possible.

Diagnosis.—Chancre of the lip sometimes renders the diagnosis somewhat difficult. Carcinoma, as we have seen, occurs almost always in men; chancre is more frequently observed in women than in men, and may occur at any age, while cancer seldom occurs before the fortieth year. The progress of cancer is slow and the involvement of lymphatic glands is tardy; chancre advances rapidly, lasts but a few weeks, and the glands are soon involved. Finally the secondary manifestations appear in syphilis and greatly improve under specific treatment. Cancer progresses regardless of all internal remedies.

Prognosis.—In Fricke's statistics operative procedures resulted as follows: 8 per cent. died as an immediate result of the operation, 32 suffered from recurrence, and 60 per cent. were permanently cured. The prognosis of labial cancer is therefore good if operation is resorted to—before, however, the maxillary and parotid glands are involved in the cancerous process. The prognosis is also unfavorable when the infiltration has reached the jaw or has extended to neighboring organs.

Worner collected, from 1843 to 1884, 866 cases of labial cancer which had been operated. Of these 28.1 per cent. recovered permanently. Maïweg in his thesis collected 182 operated at the Bonn clinic from 1866 to 1887. Of these 57 recurred and died; 44 recovered, but had not yet completed the third year after the operation; 32 have passed the third year since the operation without recurrence; 49 have already completed the sixth year since the operation and have not relapsed. Forgue (*Gaz. des Hôp.*, Mar. 25, '90).

Treatment.—Local treatment by caustics and other "specifics" but compromise the ultimate issue. Surgical removal resorted to early affords the patient excellent chances of recovery. Of all cancers, that of the lip has shown the least tendency to recur.

A carcinoma of the lip in an individual over forty is ordinarily, as Broca shows, more malignant than a cancer of the skin, and less malignant than a cancer of the tongue. The further inward on the epithelial surface the growth begins, the more malignant it is, as a rule.

The cancer may first appear as a fissure with hard edges, which declines to heal; as a slowly developing ulcer with hard edges, which refuses to cicatrize; as a hard papule in the mucous membrane, which does not ulcerate for a considerable time; or as an eczematous-looking surface, which weeps and crusts, and is covered with papillomatous projections. The first three forms spread

deeply under the epithelium and involve the muscle of the lip comparatively early; the last-mentioned form is superficial and does not involve the muscle until late. The first three forms are more malignant than the last form, although the papule may remain inactive or latent for a considerable length of time. The sooner the muscle of the lip is involved, the more malignant is the growth.

In whatever form cancer starts, even if it is not ulcerated from the beginning, it sooner or later ulcerates, and the characteristic epitheliomatous ulcer forms. In its earliest stages this ulcer is apt to be concealed by a crust; and, if the crust is picked off, the raw surface is exposed. The discharge of an epitheliomatous ulcer is thin, reddish sero-pus, which is irritating to the surrounding healthy skin and mucous membrane.

The only proper treatment for cancer of the lip is radical extirpation at the earliest possible moment, associated with removal of the anatomically related lymphatic glands. J. C. Da Costa (*Therap. Gaz.*, Feb. 15, 1901).

Miscellaneous Growths.

Besides the varieties of neoplasms enumerated and which do not depart, in the physical phenomena, from similar neoplasms observed elsewhere in the organism, NÆVI are sometimes witnessed in this location. But, as a rule, they are small and may generally be removed by ignipuncture, a fine galvanocautery-knife being used, or by electrolysis. The latter is slower, however. Dissection, as if the growth were a malignant one, is sometimes necessary.

For deformities of lips and mouth, see PLASTIC SURGERY.

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Philadelphia.

MOVABLE KIDNEY. See URINARY SYSTEM, DISEASES OF (SURGICAL).

MUMPS. See PAROTITIS.

MUSCLES, DISEASES OF.

Progressive Muscular Dystrophies.

This is a general name applied by Erb to several clinical types of progressive muscular degeneration with or without preliminary hypertrophy, involving various groups of muscles, and due to primary morbid changes in the muscles themselves. The disease is markedly hereditary in type. Erb subdivides the progressive muscular dystrophies into two classes:—

1. *The progressive muscular dystrophy of infancy.* This includes the hypertrophic form, formerly known as *pseudo-hypertrophic muscular paralysis*, which really represents two types: (a) one in which the hypertrophy is fictitious, the muscles having undergone lipomatosis, and (b) one in which the hypertrophy is real, the muscle-fibres having become enlarged.

The atrophic form, consisting, in turn, of two types: (a) the *infantile type of progressive muscular atrophy* of Déjerine-Landouzy, in which there is muscular atrophy of the face, shoulder, and arm (infantile form of Duchenne), and (b) a form in which the face is not involved.

2. *The progressive muscular atrophy of youth and adult life*, Erb's juvenile atrophy, which usually begins in the scapulo-humeral muscles.

Symptoms.—The earliest manifestations of the disease denote impairment of muscular power. The child's movements become awkward, and resort must be had to various stratagems to accomplish what previously was done without difficulty. In climbing stairs, for instance, the patient finds it necessary to grasp the banister, while he pulls himself up with his hands. To rise from the ground he is obliged to first get on his hands and knees, partly raise the body by straightening the legs, then gradu-

ally reach the upright position by using his lower limbs as supports for his hands,—“climbing his legs,” as it were,—Gowers's pathognomonic sign. While standing, his legs are apart, the body is bent backward, and the abdomen projects. His gait is waddling and he frequently falls.

After a period, varying greatly in different cases, enlargement of some of the muscles becomes noticeable. The muscles of the calves are usually the first to be affected. The extensors of the thighs, the muscles of the nates (*glutei*), of the arms and of the back (the *deltoid*, *triceps*, *infraspinatus*, and *latissimus dorsi*) are usually the next to become involved, singly or in various groupings, each affected muscle standing out prominently. The patient's limbs and body may thus become very irregular in outline, one calf appearing much larger than the other, the muscles of one arm appearing unusually developed for the size of the forearm, etc. This becomes especially noticeable when, as usually happens, atrophy of adjoining muscles simultaneously occurs.

There is no electrical degenerative reaction, but the latter may be diminished in proportion to the muscular weakness present. The hypertrophied muscles are often, however, unusually strong.

The Déjerine-Landouzy type begins, usually, in the face, and gives the latter a typical appearance due to thickening of the lips, described as the “tapir-mouth.”

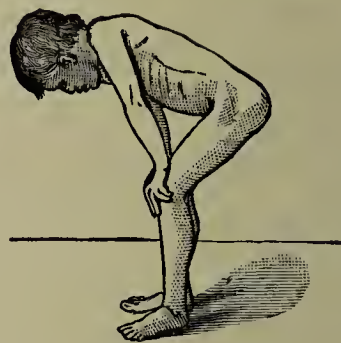
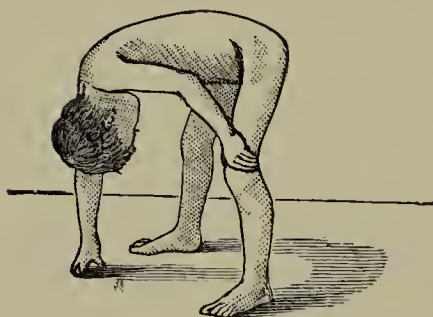
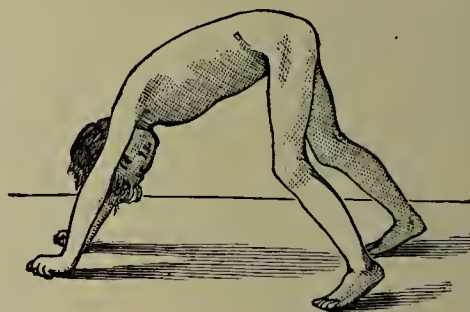
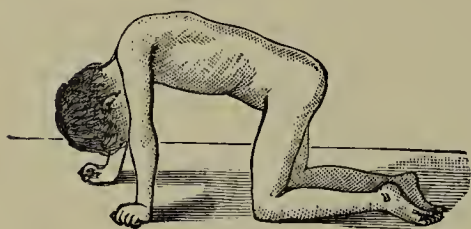
“Loose shoulders” is a symptom upon which Erb lays considerable stress. When an attempt is made to raise the child by placing the hands under his arms, the shoulders are alone raised until the level of the ears is reached; the child's head and neck sink between them, as it were, and the body seems to slip down between

the hands. The scapulæ usually stand out prominently from the spinal column, resembling wings on the point of being spread.

Case in a female aged 57. Many of the muscles of the back, the arms, and abdomen were much enlarged and hard to the touch. The affected muscles reacted feebly to the faradic current. When an excised portion was examined, the fibres were found to be twice as large in diameter as normally; the interstitial tissue was not increased, and there was no trace of fat-cells. The fibres were transversely striped in most cases; one or two, however, showed

present. Mental torpor is sometimes, and epileptoid spasms occasionally, observed. Increasing loss of physical power usually attends these cases, and death supervenes after a period of general marasmus. Some cases never reach the advanced stages of the disease; they merely complain of localized or general weakness, and die of intercurrent diseases; others rapidly show its active manifestations and die early: the *forme fruste* of French clinicians.

Etiology.—The muscular dystrophies can generally be traced to heredity, the



Attitudes assumed during attempts to rise. (*Gowers.*)

longitudinal markings. Fulda (Deut. Archiv f. klin. Med., B. 54, H. 6).

Later in the history of the disease contracture of some of the muscles gives rise to deformities: contracture of the calf-muscles, for instance, so raises the heel as to prevent its apposition to the floor. Club-foot, spinal curvatures, etc., may thus be brought about. Again, weakness of the muscles may cause lordosis, or lateral deviation of spinal column, the patient being unable to stand or even to sit upright. No sensory symptoms are

disease being usually transmitted through the mother, though she may not suffer from the disease herself. Thus, all the children of a woman by different husbands have suffered from the malady. It may occur successively in two or more generations or merely show a family tendency by attacking only some of its members through several generations. A large number, twenty to thirty, have been traced in but five generations. The disease usually appears early in life, very seldom after the twenty-fifth year. Males

are more frequently affected than females.

Diagnosis.—In sufficiently advanced cases the diagnosis is not difficult, especially when hypertrophy of one or more muscles is present. When this distinctive feature is absent, confusion with other forms of progressive atrophy is possible.

PROGRESSIVE MUSCULAR ATROPHY OF CENTRAL ORIGIN.—In this form the small muscles of the hands are usually the first to atrophy. The degeneration-

or other factors capable of causing neuritis shows the latter to be the primary disorder. Heredity plays a subsidiary rôle, and paralysis is more evident than true atrophy. The “steppage” gait of peripheral neuritis is present when the muscles of the legs are involved.

MUSCULAR ATROPHY OF TRAUMATIC ORIGIN.—There is a clear history of direct injury, fracture, contusion, etc., impairing directly or indirectly the nutrition of the affected group of muscles.



Pseudohypertrophic paralysis. (*Duchenne.*)

reaction is present. It begins late in life, and heredity is by no means a common etiological factor.

PROGRESSIVE MUSCULAR ATROPHY OF NEURAL ORIGIN first shows itself in the smaller muscles of the extremities. There is a noticeable decrease in the electrical excitability, while fibrillary contractions and sensory symptoms are present.

MUSCULAR ATROPHY FOLLOWING NEURITIS.—A history of lead poisoning

The anatomical relations between the region injured and the atrophied muscles usually render the diagnosis easy.

Primary muscular dystrophy in two brothers. The parents were healthy. In both cases there was slow onset in childhood; atrophy affecting the shoulder-girdle, upper arms, and thigh. Theodore Diller (*Med. Rec.*, Nov. 7, '96).

Pathology.—The disease is, according to Erb, a primary myopathy, the cord and motor nerves showing, as a rule, no alter-

ation. Rarely morbid changes in the cells of the ventral horns have been observed, but these may not have been connected with the myopathy. The muscular fibres simultaneously show various stages of morbidity, some being atrophied, others hypertrophied. Fat may be present in the interstitial connective tissue and constitute the pseudohypertrophy alluded to. The first changes, however, usually consist in true hypertrophy of the muscular fibres, followed by fissure and increase of nuclei, while the connective tissue becomes greatly increased in the perimysium internum. The stage of atrophy then follows and progresses steadily.

Case representing a form of precocious amyotrophy of rapid course with predominating symptoms in the lower limbs, and belonging, therefore, to the disease called by Hoffman "progressive spinal amyotrophy of early infancy." The affection is characterized by the rapid atrophy of the muscles, the presence of adipose tissue, and a secondary lordosis with muscular retraction. Fibrillary twitchings may or may not be present. Pathologically there is simple atrophy of the muscles, and degeneration or disappearance of the cells of the anterior cornua of the spinal cord and of the anterior roots. The prognosis is unfavorable, death usually occurring not later than the sixth year. There are numerous transitional forms of the disease. P. Haushalter (*Revue de Méd.*, June 10, '98).

Histories of 20 cases collected from records of the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases. Most of the patients presented the form known as pseudohypertrophy. Four of the patients were of the female sex; all were white. Attention is called to the rarity of dystrophies in pure blacks. In 11 of the cases infectious diseases had preceded the onset of the dystrophy. In only 2 cases did similar disease exist in another member of the same family. As to the pathogenesis of the disease, nothing is

known. A. A. Eshner (*Amer. Jour. Med. Sci.*, Sept., '98).

Cases of muscular atrophy occur which present the well-known localizations regarded as characteristic of the different forms of muscular dystrophy. In the large majority of these cases the spinal cord and peripheral nerves are normal. In other rare cases presenting the clinical features of muscular dystrophy, the nervous system is more or less involved. The histological changes in the muscles are not pathognomonic of any form of atrophy. It is proper to regard muscular dystrophy as a disease usually distinct from spinal muscular atrophy, but transitional forms connected the myopathic and myelopathic types of atrophy. W. G. Spiller (*Med. Record*, July 22, '99).

Two cases of progressive muscular dystrophy in mother and child. Erb's contention that the various forms of this disease are identical is correct. A child, eight years of age, suffered from a typical infantile atrophic form of progressive muscular atrophy. The mother, aged forty-two years, had a hypertrophic form of dystrophy, which appeared after the birth of the dystrophic child. These circumstances render the cases recorded very unusual. Brasch (*Berliner klin. Wochen.*, Jan. 18, 1904).

Treatment.—Muscular exercise is thought by Gowers to stay the progress of the disease. Electricity and massage carried out assiduously have also been recommended, but no treatment has so far brought about complete recovery. The general health should receive the greatest attention, tonics, nutritious food, fresh air, etc., by increasing the vigor of the organism, tend to delay the progress of the degenerative process. When the patient is bedridden, care should be taken that the contractures do not cause flexion of limbs in awkward positions.

Progressive Muscular Atrophy of Central Origin.

This is a progressive atrophy of the muscles, combined with more or less marked rigidity, usually beginning in the

hands, and due to chronic degeneration of the spinal motor tract. (See SPINAL CORD.)

Progressive Neural Muscular Atrophy.

This is a progressive atrophy observed in children in which the muscles of the feet and the peroneal group are usually first affected, as the result of chronic interstitial neuritis. (See PERIPHERAL NERVES.)

Infectious Myositis.

The various forms of muscular inflammation due to rheumatism, gonorrhœa, pyæmia, and other infectious disorders, etc., are reviewed under the heads of the causative affections. This article only includes, therefore, the form of myositis which occurs as the result of infection.

Symptoms.—Slight fever and enlargement of the spleen are often noted early in the history of myositis. Swelling, stiffness, and tenderness of the muscles, slight œdema of the hand or foot, according to the extremity first involved, tension of the skin over the affected part, represent about all the earlier symptoms observed in all cases. Apart from these, the symptomatology varies according to the causative affection. In some there are disorders of sensation greatly suggesting a kinship with peripheral neuroses; others so simulate progressive muscular atrophy that a diagnosis is quite difficult. Again, trichinosis is suggested by many of the local and general manifestations, and the diagnosis cannot be established without a microscopical examination involving the removal of a small section of the affected muscle. Diffuse purulent infiltration sometimes follows the local inflammatory process, reaching in some cases to gangrene. An erythematous rash is sometimes observed. As the disease progresses the use of the member affected becomes increasingly impaired, locomotion being quite dif-

ficult and painful when the muscles of the legs are the seat of disorder. The œdema is first limited to the extremities, invades the trunk, then the face, giving the latter a bloated appearance suggesting myxœdema. The muscles of deglutition, mastication, and respiration being occasionally involved, the general nutrition greatly suffers, while dyspnœa may become distressing. Inflammatory disorders of the respiratory tract sometimes occur concurrently, pneumonia, even, having been observed as a terminal complication. The affection usually lasts between three and four months, though chronic cases may last much longer.

Symptom so far unrecognized, namely: an effusion into the cellular tissue over the muscles after the myositis has subsided somewhat. This effusion is not great, but it gives rise to an audible crackling that can be elicited by moving the skin over the affected muscle. One may find this especially well marked in cases of intercostal rheumatism. A. G. Miller (*Scottish Med. and Surg. Jour.*, Sept., '98).

Etiology and Pathology.—The evidence at hand tends to show that an infectious principle, the nature of which is still unknown, is the direct pathogenic agent. Marked proliferation of the interstitial tissue, fatty degeneration, or hyaline degeneration of the muscular fasciculi have been noted microscopically (Hueppe).

Three cases of myositis occurring in the second and third weeks of scarlatina after the subsidence of acute symptoms. This complication is unaccompanied by fever, and disappears rapidly, as a rule. It can hardly be distinguished from ordinary muscular rheumatism. Bruck (*Gaz. degli Osped.*, July 7, '98).

Treatment.—In a study of eleven cases Cayet found that the most satisfactory treatment consists in leeches or other antiphlogistic measures at first, and mercurial or iodide-of-lead ointments later

on. The use of electricity did not seem to be particularly indicated, but systematic massage is very valuable. Care must be taken, however, to alternate it with sufficient intervals of muscular rest. The cure is best completed by means of graduated exercises and passive movements.

Gowers has expressed himself hopefully in reference to the nitrate of strychnine treatment of progressive muscular atrophy. The writer confirms in part Gowers's favorable statement. He employs $\frac{1}{25}$ of a grain hypodermically, given daily for six weeks. The treatment is resumed after an intermission of two weeks, and so on until several courses have been taken. Many patients can bear a larger dose, but better results are obtained when the particular dose is adhered to. He claims that strychnine nitrate given hypodermically is the only form that should be employed. When given by mouth it does not have the same influence on the course of the disease. Sanger Brown (Medical Record, Aug. 6, 1904).

Polymyositis.

Polymyositis is a condition in which there is a simultaneous inflammation of many muscles and of some nerves, the inflammation being symmetrical in its distribution. (Gowers.)

Symptoms.—The affection presents the general distribution of polyneuritis so far as preponderant loss of power is concerned, but with a far wider implication of the muscles, of which many suffer that escape in ordinary polyneuritis. At first they are very tender, and later they undergo hardening and contraction, which may be extreme in degree, and after a time may be insuperable and resist all efforts to overcome it.

The cardinal symptoms are swelling of the extremities, partly from muscular swelling and partly from subcutaneous oedema, affection of the muscles of respiration and deglutition, with disturb-

ances of their functions and an exanthem. Moderate fever, profuse sweats, splenic tumor, with death from inhalation-pneumonia or from suffocation, are common.

Etiology.—The condition is almost exclusively the result of exposure to cold, and seems to be due to a peculiar variety of the rheumatic poison produced in especially susceptible individuals, rendered so by some influence that depresses the general health (Gowers). A vegetable parasite, a toxin, and an animal parasite (gregarina) have been variously considered as pathogenic factors. Syphilis gives rise to a condition resembling acute myositis.

Two cases, one occurring in a diabetic in whom evolution took place in fourteen days, terminating in death, and the other in a healthy man, following the eating of shrimps, and cured in two months. In the first intense interstitial myositis found, with proliferation of the nuclei between the fibres, particularly in the perifascicular and perivascular connective tissue. The intrafibrillary tissue was oedematous. Senator (Deut. med. Woch., Sept. 28, '94).

Case presumably of syphilitic origin. The patellar reflexes were exaggerated. On incision into the left gastrocnemius a light brownish-red fluid escaped containing fragments of old blood-clots. Bacteriological examination of this fluid and of the excised muscle were negative. The excised muscle exhibited the diffuse inflammatory change, with hyaline degeneration. James Herrick (Amer. Jour. of Med. Sci., Apr., '96).

Case in a married woman aged 36. The symptoms indicated that polyneuritis, as well as polymyositis, was present. W. R. Gowers (Brit. Med. Jour., Jan. 14, '99).

Case of acute hæmorrhagic polymyositis in which microscopically the muscle-fibres showed more or less degenerative change, increase in the number of nuclei, and interstitial hæmorrhages. There was

also extensive round-cell infiltration in the muscles. Pure cultures of the staphylococcus pyogenes aureus were obtained. J. Bauer (Deut. Archiv f. klin. Med., Dec. 13, '99).

TREATMENT.—The only hopeful treatment of this condition consists in well-directed measures applied during the stage of development.

Iodide of potassium, strychnine, and electricity seem indicated in these cases besides the symptomatic treatment usually recommended.

Muscular Hypertrophy.

True hypertrophy of the muscles differs from pseudomuscular hypertrophy in that it is attended by fewer disturb-

between the muscular fibres, occurring as a result of inflammation. Fulda considers it as a trophoneurosis resulting in a true hypertrophy.

TREATMENT.—Treatment by electricity is valuable in these conditions, possibly along with a course of the iodides. The faradic current should be used five minutes every day and massage employed.

Progressive Ossifying Myositis.

Definition.—This consists of an inflammatory affection of certain muscular tissues, resulting in a deposit of bony material in the course of the muscle, displacing its substance and finally leading to ankylosis of the affected part.



Myositis ossificans. (Stonham.)

(London Lancet.)

ances of nerve-function and that it may sometimes be arrested by the application of the galvanic current. It may be preceded by pain in the muscles only or may occur as a sequel to infectious fevers: typhoid, influenza, etc. As a rule, many muscles enlarge simultaneously. In a case witnessed by Fulda the majority of the muscles were hypertrophied, and deglutition was rendered very difficult. None of the muscles of the body showed any trace of atrophy in a case studied by Pal.

ETIOLOGY.—The nature and causes of this affection are obscure. Lesage considered it as due to a deposition of fat

Symptoms.—Slight fever, redness of the skin over the muscles of the neck and back, and swelling of the latter constitute the first manifestations usually noted. After some time, a period of apparent improvement, the muscles become increasingly harder to the touch: the first indications of the ossifying process, which progresses very slowly. The calcification is such sometimes as to transform the majority of the muscles into bone-like masses of extreme hardness. The total loss of contractility thus engendered naturally gives rise to pseudo-ankylosis, the subject being reduced, as regards motion, to the condition of stone:

the "ossified man" of museums. Only forty cases have been recorded so far.

The disease seems to attack children or adolescents, and is not steadily progressive, but comes on in fits and starts, each attack being associated with considerable pain and the appearance of a swelling in the substance of some muscle, which diminishes in size after a time, but leaves behind it a tumor of bony consistency. During the attack there is some fever, and possibly also local glandular enlargement.

Case of generalized myositis ossificans, which began at the age of 19, involving at first the whole of the right side. Tumefactions occurred in the regions of the muscles attacked. In the spring of every year the swelling extended to the left side. Considered as an affection of the bones secondarily involving the muscles. Virchow (*Berl. klin. Woch.*, Aug. 6, '94).

Death frequently occurs as the result of pulmonary disorders or of suppuration with septic absorption.

Etiology.—Local injury giving rise to myositis is thought to be the primary factor in many cases, especially when the subject presents a congenital predisposition to the formation of bone in inflamed parts. It is closely allied to rheumatism, and is sometimes found in subjects showing congenital malformations, especially hallux valgus and microdactylia (Stonham).

Case of progressive ossifying myositis observed in a girl of 4 years. The left sterno-cleido-mastoideus had undergone osseous transformation and was removed, but soon afterward new osseous deposits formed. Studsgaard (*Satellite of the Annual*, Mar., '92).

Case of myositis ossificans in a boy 9 years old. The bones were, for the most part, hypertrophied and irregularly formed. The case showed an association with hallux valgus and microdactylia. Weldon Carter (*Lancet*, Feb. 10, '94).

Study of a bony growth which had

been removed from the deltoid. To the naked eye the tumor looked like a fibroma, although there were scattered through it several reddish areas due to a persistence of normal muscular fibres. Microscopically it was found that there was an abundant infiltration of the connective tissues with round cells, while here and there cartilaginous nodules appeared, and throughout the newly-formed tissue bony material was deposited; the muscular substance proper was simply atrophied, and in no way involved actively in the process. Lexer (*Langenbeck's Arch.*, B. 50, H. 1, '97).

Case of myositis ossificans in a girl 4 years of age. The child was healthy to the age of two years, when the right shoulder began to get stiff, then the neck and the back were attacked, and two years later the disease had progressed so far that she was not able to dress herself or to rise when in a recumbent position. Neither hereditary disposition nor infection was proved. Large portions of the muscles of the neck and back are ossified, forming a cuirass by which the scapulæ are fixed; osseous bands and prominences are felt on the back, on the front of the thorax, and in the muscles of the arms. In both feet the hallux is shorter than normally and deviated into valgus position. This deformity has, in all cases observed, been found to coincide with the myositis ossificans. Nicolaysen (*Norsk Mag. f. Laegevidensk.*, p. 468, '99; Report of F. Levison, *Corr. Ed.*).

Analysis of 12 cases of ossification of muscle-tissue following traumatism. Careful study of these cases demonstrated that at different times repeated hæmorrhages had taken place in the various muscular layers, and that each of these hæmorrhages was followed by a new formation of bone. The hæmorrhage within the muscle, the following proliferation of connective tissue, and the further metaplasia into bone and cartilage held one to the other an inseparable etiological connection. Therefore, taking also into consideration the form and position of the bony deposit, it must be accepted that the formation of bone does not come from the periosteum, but is

of intramuscular origin. C. Rammstedt (Archiv f. klin. Chir., B. 61, H. 1, 1900).

Treatment.—Nothing yet employed has seemed to arrest the process of ossification.

Myasthenia Pseudoparalytica.

Myasthenia pseudoparalytica is a disease characterized by exacerbations of extreme exhaustion of certain muscles and involving, among others, those of respiration and deglutition.

Symptoms.—The onset is usually acute. The muscles of the face, those of deglutition, and the external eye-muscles are often the first affected, the least continued effort in which these are utilized being followed by their complete exhaustion and paresis. Strabismus, when the eye-muscles are involved, great difficulty in deglutition, etc., may thus occur suddenly. The same exhaustion occurs after repeated electrical stimulation (Golly). After a period of rest the muscles gradually recover some of their tone and their functions are resumed. In some cases persistent paralysis ensues. Myasthenia sometimes proves fatal.

Pathology.—Myasthenia is thought to be a form of bulbar paralysis, the organic lesions affecting particularly the lower motor neurons. This view is hypothetical, however, and is based mainly upon isolated symptoms observed in other disorders, no clearly-defined local morbid changes having so far been discerned.

Treatment.—But few cases of myasthenia have so far been reported and no special therapeutic measures have been proposed.

The symptoms of myasthenia gravis are always rendered worse by bodily exercise and mental excitement. Hence, complete rest for mind and body should be the aim of treatment. The patients are from the very first in imminent danger of death, and their relatives should be warned of this, otherwise the deceptive lulls in the symptoms may encour-

age fatal indiscretions. Frequent physical examinations may have disastrous results. Meals should be small, easily assimilated, and given at short intervals. The use of the stomach-tube is dangerous, and should deglutition become impossible rectal feeding is the only course to pursue. Stimulant methods of treatment by cold douching and faradism are absolutely contra-indicated. Massage and galvanism have proved useless. None of the drugs hitherto employed appear really to influence the course of the disease. Strychnine has been used without benefit by Strümpell and Dr. Buzzard. Personal patient improved under strychnine at first, but subsequently relapsed while still taking it. Thyroid and suprarenal extract have proved also ineffectual. Tonics, such as arsenic and iron, have no specific action. Perhaps a more extended trial of suprarenal extract might be worth making. Other organic extracts—such as cerebrin, myelin, didymine, and ovarian substance—may also conceivably be of service in a toxæmia which produces no visible changes in any part of the nervous system. Failing these medicaments, one can only hope that the toxin of myasthenia gravis may be traced to its source, isolated, and its antidote found in the chemical and physiological laboratories. Morbid anatomy has thrown no light on the nature of the disease. L. G. Guthrie (Lancet, Feb. 9, 1901).

Myotonia Congenita (Thomsen's Disease).

A disorder in which certain groups of muscles, when voluntarily contracted, remain in a state of tonic cramp a short time, then gradually become relaxed.

Symptoms.—When a patient suffering from myotonia grasps an object, the hand closes normally around the latter, but the grasp persists, notwithstanding his effort to open his hand. The cramp may be of brief duration and the patient almost immediately begin to straighten his fingers, or it may last some time, especially when the extremity is used after a period of rest. Continued use improves the mus-

cular movements, and if the object is seized and dropped several times in succession the operation becomes sometimes normal. The same phenomena may appear when the patient starts to walk: one leg being put forward slowly, it remains stiffly in the extended position a couple of seconds, when it can be used as a resting-point for the trunk by the use of the extensors, while the other leg is advanced. After a few steps have been taken but little difficulty is experienced. Sudden use of the lower limbs after a period of rest may thus become a source of danger, the patient falling heavily, owing to sudden cramp of the muscles upon which he depends for the maintenance of the erect position. Excitement, cold, and overuse also predispose the muscles to tonic cramp.

The muscles of the arms and legs are usually the only ones affected. The muscles of deglutition, the sphincters, and the non-striated muscles are never involved; the facial, laryngeal, or ocular rarely. In a case reported by Ballet and Marie the eyes became fixed when turned upward and their position could only be altered gradually. The patients are usually strong, though not in proportion to the muscular development, which is often unusual. Distinct hypertrophy is sometimes observed. The disease gives rise to little physical suffering, but mental torpor and a tendency to melancholia have been observed in a small proportion of cases. Erb has called attention to the fact that the electrical reactions of the muscles were characteristic: their mechanical irritation is increased, but, instead of contracting suddenly, they only do so slowly, the act being followed by a prolonged tonic after-contraction. While the constant galvanic current is being used it gives rise to rhythmical wave-like contractions of the body of the mus-

cle, the "flow" going from cathode to anode.

The affection, which begins early in life, usually continues uninterruptedly until death from an intercurrent disorder. Some cases, however, are attended by exacerbations and remissions; in a very small proportion of cases the improvement is permanent.

Etiology.—Myotonia is hereditary in the majority of cases. While other forms of spasm simulate it, the typical disease has always occurred in family groups. In the family of Dr. Thomsen, who first described the disease and who was himself a sufferer, myotonia was traced through five generations. Fright and overuse of the muscles seem to act as predisposing factors. It is more frequently observed in males than females. The disease is rarely observed in the United States.

Case of a man in whose family Thomsen's disease, as usual, was hereditary. The first symptoms showed themselves at the age of 6 years and were present at the onset in winter only, the patient being in good health during the summer. O. Hollmann (*Schmidt's Jahrb.*, Jan., '95).

The initial lesion is muscular hyperplasia. Hypertrophy is found mostly in those muscles which perform the greatest amount of work; it is of functional origin, with integrity of the nervous system. Déjerine and Sottas (*Le Bull. Méd.*, June 5, '95).

Case of Thomsen's disease in a patient 28 years old, and who had not been affected by the trouble until he was 18 years of age; hence there is no propriety in calling such a case "myotonia congenita." Cases divided into three classes as follows: (1) myotonia congenita, (2) myotonia acquisita, and (3) myotonia transitoria. G. W. Jacoby (*Med. News*, Jan. 1, '98).

Pathology.—The exact pathology of myotonia may be said to be unknown.

Hypertrophy of the muscle-fibres—some being double the normal size—with a multiplication of nuclei affecting the entire muscular system, except the myocardium, were observed by Déjerine and Sottas. The peripheral nerves and the spinal cord showed no morbid change.

Treatment.—Gymnastics or systematic stimulation of the muscles by co-ordinated exercises, frictions with oil, and massage may be tried with some hope of mitigating the intensity of the manifestations. Marriage proved of great value in the case of a young female.

CHARLES W. BURR,
Philadelphia.

MUSCLES, SURGICAL DISEASES OF. Strain and Rupture.

What is usually termed a "sprain" signifies an undue stretching of the muscular fibres or their tendinous extremities. It may vary in severity from a slight overextension to absolute rupture. The rupture in severe cases may be partial or complete, the latter being more likely to occur in long-bellied muscles. Rupture of the fibres is often attended by an audible snap, and gives rise to instant pain, which may become excruciating in severe injuries,—the *coup de fouet* of French authors; the patient finds it impossible to perform movements involving the use of the injured muscle. If the tear be marked and near the surface a gap in the tissues may sometimes be felt, corresponding to the ecchymosis, or fluctuating extravasation of blood, of which the injured region is the seat. When the rupture occurs at the knee, marked effusion of the joint soon follows, as in rupture of the quadriceps tendon at its insertion into the patella. When an abdominal muscle is the seat of rupture a ventral hernia may be developed.

Etiology.—Subcutaneous rupture only occurs when the muscle is submitted to the disintegrating action of great force, or when, through the influence of age or infectious general diseases (particularly rheumatoid arthritis, typhoid fever, etc.), the muscular and fibrous tissues have undergone some process of degeneration. Under such circumstances spontaneous rupture may occur under the influence of slight muscular exertion,—indeed, without any violence, sometimes, through the muscles' own contractile force. Thus, the rectus abdominis may be ruptured during labor merely through its own contractions. Tendons, especially the tendo Achillis, often give way when persons of advanced age jump or dance.

Treatment. — Moderately severe injuries tend to recover without complications under appropriate measures. The torn ends should, as much as possible, be held in apposition by immobilizing the part in a position wherein the injured muscle or tendon is completely relaxed. New tissue is developed between the separated ends. At first the new tissues are adherent to adjoining structures, but the adhesions are gradually stretched and absorbed when the patient resumes the use of the muscle. Rupture of the tendo Achillis, for instance, is best treated by immobilizing the leg in the fixed position; a collar around the thigh serves for the attachment of a cord the other end of which is attached to the heel of a soft slipper; rupture of a thigh-muscle, on the contrary, requires full extension of the limb in a splint, etc. The parts should be given absolute rest by the avoidance of all motion, and *slight* compression should be exercised upon them by means of a bandage. When the rupture occurs in a healthy muscle, it may sometimes be necessary, to hasten the recovery or to prevent a long sojourn in

bed (a dangerous practice in aged subjects), to expose the parts under strict antiseptic precautions, uniting the separated ends by sutures.

Hernia of Muscle.—Sometimes the fascia, or sheath overlying the muscle, fails to heal, and a portion of the muscle protrudes. During its contraction this becomes especially marked, and an elastic, fluctuating tumor is formed. The muscles of the thigh and abdomen are most prone to this condition, especially if overexertion too soon after the injury is not avoided. Healed fascia under these circumstances may also be torn anew.

Muscular hernia may readily be recognized by the fact that it disappears or becomes prominent according to the proximity of the contraction imposed upon the muscle by motion.

TREATMENT.—Rest and well-adjusted pressure with a hernial bandage are usually sufficient in recent cases. When much discomfort is caused, or the hernia is an old one, the skin should be incised and the edges of the torn fascia be freshened and united with catgut sutures.

Ossification.

Localized strains, when repeated, sometimes give rise to local inflammation, culminating in ossification of a part of the muscle. The "rider's bone" is an instance of this complication which is occasionally observed in persons who do rough horseback-riding. The process of ossification takes place in the adductor longus here, but it may occur in any muscle submitted to undue mechanical action. When located in a superficial muscle the "bone" may usually be detected by pressure, but when deep seated it is not recognized during life. Ossification may also be due to syphilis. (See also MYOSITIS OSSIFICANS under MUSCLES, DISEASES OF.)

TREATMENT.—The bony growth does not occasion serious discomfort in the majority of cases, but at times it gives rise not only to local pains, but also to impairment of the functions of the affected muscle. It should then be removed surgically, all milder methods being futile.

Muscular Dislocation.

Dislocation of muscles and tendons are occasionally observed, when laceration of the fascia, synovial sheaths and violence concur to cause them to slip over the bony prominence. Dislocation of the peronei muscles over the external malleolus may thus occur during severe wrenches or sprains. The long tendon of the biceps may also be displaced from its groove. The extensor tendons of the wrist are especially prone to this difficulty. Considerable pain and inability to use the affected limb are at once experienced, and the use of the limb is more or less compromised until reduction is effected.

TREATMENT.—In recent cases reduction of the displaced structure is easily effected by relaxing the muscle and manipulating the member according to the nature and direction of the dislocation. Thus, in dislocation of the peronei, rotating the foot outward is indicated; a retentive bandage is then applied and kept until complete recovery is obtained. When the tendon will not remain *in situ*, the groove in which it lies may be deepened by exposing the bone and gouging it subperiosteally, as recommended by Albert.

Wounds of Muscles.

Subcutaneous, incised, or lacerated wounds of muscles are frequently met with, especially the latter. Under modern asepsis, unless the loss of tissue be very great or the supply of arteries and nerves be seriously injured (when gan-

grene is apt to occur), resolution usually occurs promptly in small wounds through regeneration of muscular tissue, and in extensive ones through cicatricial connective-tissue formation. The functions of the injured muscle are often restored under circumstances that would seem to preclude all hope.

TREATMENT.—In lacerated, contused, and incised wounds of any severity, the torn edges, if any are present, should be trimmed off, then united with catgut: buried sutures. Under aseptic precautions this procures early recovery and the minimum of deformity. In mild injuries close apposition by strapping and rest are usually sufficient.

Muscular Atrophy of Traumatic Origin.

Wasting of a muscle may be of trophic origin through disuse, but also through involvement in injuries of some of the channels through which the nutrition occurs, compression, laceration, etc. Atrophy may thus follow fractures as a result of inactivity, but in the majority of cases reflex disturbance of the trophic nerves is the main cause of the wasting. A fractured limb often affords indications that the nutrition of the limb is impaired, the preliminary factor in atrophy, and simultaneously a warning that its development should be prevented by local warmth, gentle massage, etc.: *i.e.*, measures calculated to sustain the vitality of the limb while it is immobilized. Pressure upon the blood-vessels may also act as a predisposing factor through malposition of the limb or the constriction of a bandage. The importance of avoiding prolonged sojourns in bed, in the case of aged patients, is obvious.

Nerve-injuries, diseases of the joints, diseases of the spinal column, etc., also act as causes of muscular atrophy by interfering with the nutrition of muscles

either directly or through reflex influence bearing mainly upon the vascular supply. (See also MUSCLES, DISEASES OF.)

TREATMENT.—When the limb merely becomes thin through disuse while in a splint, light massage, if normal resolution does not soon follow its release, soon causes rapid improvement. *Effleurage*—*i.e.*, strokes directed *toward* the trunk (to activate the circulation) made with the palm of the hand or its radial border—is indicated at first; subsequently, when the limb has become stronger, *pétrissage*—*i.e.*, seizing the tissues with both hands and raising them (as a cat is lifted by the neck) repeatedly, followed by kneading of the parts thus raised—should be resorted to. Strychnine should also be administered internally.

In atrophy due to lesions of nerves, bones, etc., the cause should first receive attention.

Traumatic Myalgia.

Muscular pain, rendering the use of the muscle involved more or less difficult, is a frequent result of overuse, especially when the sufferer is not accustomed to arduous labor. Bicycle-riding, horseback-riding, trunk-packing, etc., thus often became a cause of myalgia, the result of fatigue. After two or three days' rest the tissues recover their normal *status*. Severe myalgia is often caused by strain, twisting, blows, falls, compression, etc. All these factors are most active in causing myalgia in persons subject to rheumatism. (See RHEUMATISM, MUSCULAR.)

TREATMENT.—Heat, light massage, and electricity are valuable remedial means. Compresses of warm or cold water, or a mustard poultice placed some distance away from the sensitive spot hasten resolution when spontaneous subsidence is not prompt.

MYOSITIS. See MUSCLES, DISEASES OF.

MUSCULAR ATROPHY. See MUSCLES, DISEASES OF.

Contracture.

Permanent fixation of a muscle in the contracted state may be caused by a large number of factors: inflammation of local or remote tissues, traumatic, diathetic, or toxic agencies, etc. Hemiplegia, for instance, is often complicated with contracture of all the muscles of the upper extremity. The arm is usually held against the body, the hand being flexed upon the forearm and the latter upon the arm: a general contracture of the flexors. In some cases the forearm is merely flexed upon the arm, the latter being free at the shoulder. When this variety occurs in a young woman, hysteria is to be suspected. Contracture of this character may also be due to rheumatism or syphilis, the biceps being the seat of an exacerbation of either disease. Permanent contracture often follows severe traumatism when appropriate curative measures are not immediately instituted. Burns involving the deep cellular tissue and attended by much destruction are also apt to be followed by cicatricial contracture when the region of the elbow or the palmar tissues are involved. Chronic inflammation of a muscle, descending neuritis, persistent irritation along some portion of the motor tract, or prolonged disuse of a muscle if it remain in a given position, weakened action of an antagonistic muscle whether of central or peripheral origin, contiguous bone or joint disease, tumors pressing upon a given set of muscles or its nervous supply are all capable of giving rise to contracture.

The lower extremities are also susceptible to the same influences. Besides the disorders that enter the field of neurology, spasmodic rigidity, and other

conditions which sometimes require tenotomy or myotomy, we occasionally witness contraction of the muscles of the thigh occurring as a result of dislocation or hip disease.

Diagnosis.—Contracture—*i.e.*, permanent shortening of muscles—must be differentiated from temporary rigidity, such as is witnessed in the early stage of inflammation of a joint and in hysteria. The fact that in these disorders the muscles relax under an anæsthetic, whereas in permanent contractures they do not, affords an easy and certain way of determining this question. The history of the case usually facilitates the recognition of the origin of the trouble in individual cases. Non-traumatic cases are usually the result of cerebral or spinal lesions, and, in children, of infantile paralysis, owing to the reduced resistance of affected muscles. Spinal inflammatory disorders are usually attended by marked flexion at the hip and knee. As already stated, contracture of the biceps is usually of syphilitic or rheumatic origin; the same may be said of the corresponding leg-muscles.

Treatment.—The factors leading to contracture are so numerous and the forms which it assumes are so varied that each case must be treated on its own merits. In some, remedies calculated to antagonize a diathetic disorder are of primary importance. In rheumatic and in syphilitic contraction of the biceps, for instance, a course of iodide of potassium is of primary importance to antagonize the fundamental cause of the disorder and prevent recurrence after tenotomy: the second phase of the curative measures indicated. The biceps being the contracted muscle, its tendon is easily cut by passing a tenotome flatwise beneath it from within outward (thus avoiding the artery) and cutting upward

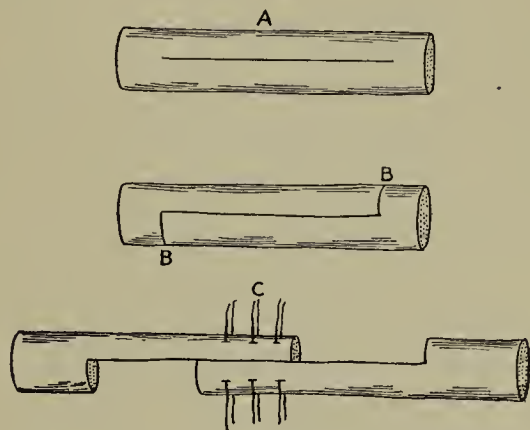
by a gentle sawing motion. The wound being closed, the arm is fastened into a straight splint, in extension, and left there until resolution of the cut parts has sufficiently occurred to warrant passive motion.

Lengthening of tendons to overcome contracture has been performed by Anderson, Keen, and other surgeons in the manner indicated in the annexed cut. The tendon being exposed, it is split longitudinally with a thin knife (*A*); each end of the cut is then continued at right angles in opposite directions (*BB*). The tendon being thus severed, its ends are superposed as shown (*C*) and united by means of three catgut sutures. The wound is then closed. Properly performed, this operation procures excellent results. The longer are the united surfaces, the greater are the chances of a successful issue.

When, as a result of operative procedures, the normal action of the muscle cannot be obtained, notwithstanding additional measures such as massage, electricity, friction, etc., and the internal administration of strychnine, it can be supplemented by the use of India-rubber bands (Sayre's rubber muscles) or springs, connected with suitably-shaped collars, which are fastened around the limb: one about where the paralyzed muscle arises and the other where it is inserted. They are usually of most service in paralysis of the leg-muscles. Simple paresis of the latter through disuse may be overcome by measures calculated to enhance their nutrition,—massage, electricity, etc.,—coupled with motion.

Conclusions in relation to paralytic deformities: 1. Prevention of deformities by means of apparatus and other measures is exceedingly important. 2. When contractions have occurred the employment of surgical measures should, as a rule, precede the application of mechanical appliances. 3. Myotomy and

tenotomy, either subcutaneous or open, are perfectly safe operations. 4. In contractures at the hip free open incision is usually preferable; at the knee subcutaneous section can frequently be performed, but when fascial contractions occur in the central popliteal space open incision is necessary and excision is occasionally demanded. At the foot subcutaneous division usually is sufficient; tarsectomy is seldom necessary. Fasciotomy is frequently required. 5. Forcible straightening following division is important. Rectification should be complete at the time of operation and all contracted tissues should be divided. 6. In spastic paralysis lengthening the tendons by tenotomy assists in restoring muscular equilibrium, and, consequently,



Anderson's operation for lengthening a tendon.

secures better subsequent locomotion.

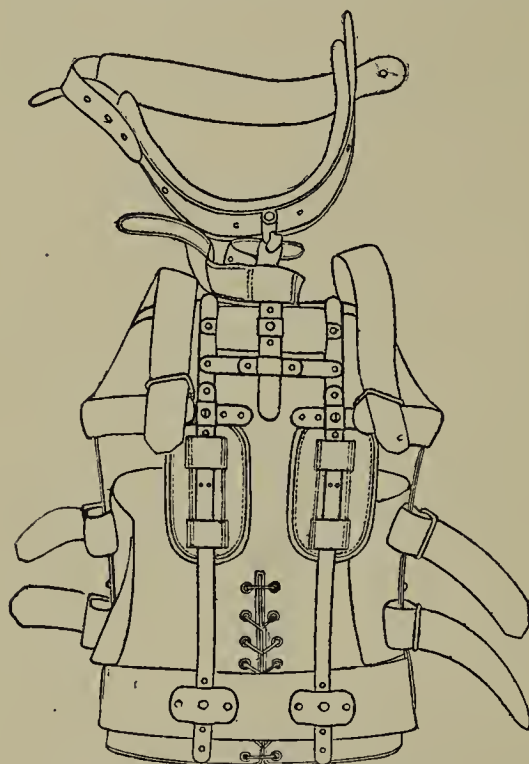
7. Free section of the adductors is often advisable. 8. The best subsequent dressing for maintaining abduction while the patient is in bed is the application of a rigid dressing to the knees. The legs can then be fastened widely apart. 9. Mechanical appliances with lock- or stop-joints are important, and artificial support by wheeled crutch or other measures will assist in restoring muscular power. De Forest Willard (*Archives of Ped.*, Sept., '94).

[In certain cases of paralysis transplantation of muscles is of service. Thus, the peronei tendons may be detached from their insertion and sewn to the tendo Achillis in paralysis of the muscles of the calf of the leg. G. G. DAVIS.]

Torticollis (Wryneck).

Torticollis is the name applied to an abnormal position of the head produced by contraction of the muscles on one side of the neck. The head is drawn downward on the affected side and rotated to the opposite side. If, therefore, the left side of the neck is affected the face is turned toward the right on a vertical axis and likewise somewhat rotated on a horizontal axis.

Torticollis usually occurs in childhood



D. W. Kolbe Co.

Torticollis apparatus. (G. G. Davis.)

and is sometimes congenital. In the congenital form it has been ascribed to intra-uterine disease or injury, such as pressure, but it is undoubtedly, sometimes, the result of injury to the muscles of the neck, particularly the sterno-mastoid, at the time of birth. In acquired cases cold or rheumatism acts at times as a cause; also affections of the throat, inflammation of the glands, and contractions from burns. Paralysis of the muscles of one side and even bad eyesight,

as extreme myopia causing monocular vision, may result in holding the head in a more or less permanently incorrect position.

A form exists in adults called SPASMODIC TORTICOLLIS from the fact that the neck is the seat of oft-recurring spasms which twist the head to one side in a very distressing manner. The cause of this form probably lies, in a considerable proportion of cases, in some disease of the central nervous system. The sterno-mastoid muscle is not apt to be the only muscle involved, the trapezius, splenius, and others being likewise sometimes affected.

Diagnosis.—Care should be taken not to overestimate the gravity of the affection. Thus, particularly in children, inflammation of the glands of the neck, tonsils, rheumatism, cervical caries, and mental or ocular affections may cause the head to be held in the position of that of true torticollis, but these cases, as a rule, do not demand operation; so that radical procedures are only to be decided on after careful exclusion of temporary causes.

Treatment.—When the affection is suspected to be temporary, treatment should be directed first to the relief of any discoverable cause. Locally, hot, moist applications: cloths wrung out of hot water or even persistent poulticing may be tried. These are to be followed by gentle massage frequently repeated. Internally, antirheumatic remedies should be given if that disease is suspected. If any local support is desired a simple one may be made of pasteboard molded to the part, padded, and bound on with adhesive straps or a bandage. If the disease is of a chronic, persistent kind, tenotomy of the sternal, and if that is not sufficient also the clavicular, origin of the sterno-mastoid muscle should be resorted to.

For this purpose an anæsthetic should be given and the tendons and any neighboring contracted bands of fascia should be divided through an open incision. Of course, the strictest antiseptic precautions should be used. It is not worth while to attempt a subcutaneous operation, as the division of all the retaining bands will not be so complete, and even in the hands of an experienced surgeon wounding of the large vessels is liable to occur. The wound having been sutured and dressed, the head is to be placed in as much an overcorrected position as possible, and kept there at least until the wound is soundly healed. One way of accomplishing this is to fix the head in the desired position by means of a plaster-of-Paris dressing, which is wound many times around the head, neck, and upper part of the chest. While the plaster is still soft the head is twisted to the desired position and held there until the plaster sets. Another means is to use an apparatus consisting of a vertical bar going down the back of the neck and fastened to a light chest-jacket. The upper end of the bar carries a cross-piece which winds around the occiput and ends above the ears. From the ends above the ears one strap goes across the forehead and another from side to side under the chin. By means of wrenches the back-bar can be bent either around on its axis or else backward or forward, and thus be adapted to the special case. A third way is to surround the head with a properly-fitting band either of metal or leather. From this goes down an elastic band to be fastened to another band of adhesive plaster on the side of the chest. Either one of these three ways can be used, although sometimes one will seem to suit the particular case better than the others.

In SPASMODIC TORTICOLLIS antispasmodic remedies—such as tincture of can-

nabis Indica—may be given, beginning with 5 drops, three times daily and gradually increasing—the case being carefully watched—until a drachm is being taken. Other remedies—such as large doses of strychnine, hyoscyamus, and the coal-tar products—may also be tried. If these fail, the spinal accessory nerve may be resected just as it enters the sterno-mastoid muscle. Attempts have also been made to divide the posterior branches of the cervical nerves also. The operation, while in some cases followed by improvement, is very apt to fail in giving much relief and the disease returns, though perhaps at times in not quite so violent form as previously.

Case of spasmodic torticollis which had persisted for a year. After prolonged treatment by electricity, hyoscin hydrobromate, and potassium bromide, without improvement, daily hypodermic injections of atropine were administered in the sterno-mastoid and neck muscles, with much success. The initial minimum dose of $\frac{1}{200}$ grain was gradually increased to a maximum of $\frac{1}{45}$. After three weeks of treatment the drug was discontinued and cure was complete for four months. A slight spasm then returned, but yielded promptly to occasional doses given during the following three months. Electricity was applied throughout the treatment. Potts (Univ. of Penna. Med. Bull., Apr., 1903).

Method of treatment employed in several idiopathic cases with excellent results. The faradic current was applied daily for five minutes by placing the positive electrode over the wrist and applying a roller negative electrode over the healthy sterno-mastoid and upper fasciculus of the trapezius on the unaffected side. An internal treatment of two drops of liquor potassii arsenitis was continued three times a day during a considerable period. Improvements in each case began at once, but it required some time before complete recovery was reached. L. K. Hirshberg (Maryland Med. Jour., Oct., 1903).

(See also TENDONS, FASCIA, AND BURSÆ, DISEASES OF, and ORTHOPÆDIC SURGERY.)

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MUSHROOM POISONING. See TOXIC FOODS.

MUSK.—Musk is a secretion of follicles contained in a sac extending from the umbilicus to the prepuce of the musk-deer of Thibet and other regions of India. It is very doubtful whether much of the musk on our markets is pure, although the Siberian musk is thought to represent the genuine substance. This should be unctuous, soft, and reddish brown. Its odor is most penetrating, causing nausea in many individuals, and even more active symptoms—headache and spasm—in sensitive subjects. It is soluble in equal parts of water and in nine parts of alcohol.

Preparations and Dose.—There is a tincture of musk (U. S. P.) of which the dose is 30 minims to 1 drachm; but pure musk, the dose of which is 5 to 10 grains, given in pill or emulsion, is usually preferred.

Physiological Action.—Musk seems to possess a peculiar action in the relief of collapse and general vital depression. How this effect is produced is hardly explained by the data at hand concerning its physiological properties, these being based upon contradictory results in almost every particular. Jorg found it to cause exhilaration without depression. Sundelin found that it could cause depression, vertigo, and drowsiness. H. C. Wood, basing his opinion upon clinical experience, thinks its action depends upon an equalization of the disturbed balance of nervous power.

Therapeutics.—Musk is a valuable stimulant and antispasmodic, especially

where trismus or other spasmodic conditions complicate acute febrile disorders. When the strength of the patient is failing and this becomes manifest not only by general evidences, but by special symptoms,—convulsions, singultus tendinum, muttering delirium, etc.,—rectal injections of musk, 10 grains to a pint of starch-water, has been highly recommended. It allays the symptoms and stimulates respiration, strengthens the cardiac and the general circulation, and seems to benefit every untoward feature of the case. In pneumonia it was often employed by Trousseau, and helps to sustain the patient through the critical period.

In all spasmodic disorders—laryngismus stridulus, in the annoying and persistent spasmodic cough following pertussis—it has shown considerable power.

Musk has been recommended in many general disorders, rheumatism, gout, etc., but the claims for it have not been sustained by clinical evidence.

MUSTARD.—Mustard, as employed in medicine, is the flour of the mixed seeds of white mustard (*Sinapis alba*) and black mustard (*Sinapis nigra*). Their property mainly depends upon a volatile oil which is developed when, after the two varieties are mixed, the flour is moistened with water at ordinary temperature.

Therapeutics.—As an emetic, mustard, a tablespoonful in a glass of water, is often used when, as in cases of poisoning, rapid emesis is required.

As a rubefacient and counter-irritant, mustard is probably used more than any other agent. It should not be employed pure, as found in households, but mixed with flour or some other inert substance to limit its irritating action—which becomes destructive if the pure mustard is

left on the skin too long. One part of mustard (English) to 4 of flour for adults, and 1 to 6 for children and women with delicate skins generally prove sufficiently irritating. The mixture should be spread evenly between two layers of muslin. Mustard-paper (U. S. P.) is a convenient substitute, but it is too strong for children. Mustard burns or irritation are slow to heal. Lime-water and olive-oil, equal parts, hasten resolution.

Mustard may be used as a styptic for almost any disorder in which pain is a prominent factor. In headaches of all kinds a mustard poultice applied to the nape of the neck is very efficacious. In gastric disorders, when applied over the organ, just below the end of the sternum, it is very helpful. In nausea it is prompt and effective.

Mustard foot-baths are very useful in the incipient stages of almost all disorders, while mustard sitz-baths are helpful in delayed menstruation. The latter, however, should not be made strong, the delicate mucous membrane of the vulva being easily irritated.

DISORDERS OF THE RESPIRATORY TRACT.—Troublesome cough—as shown by Gorodtsoff, who employed it satisfactorily in a large number of cases—is greatly benefited by mustard. The disease comprised epidemic influenza, croupous pneumonia, exudative pleurisy, pulmonary tuberculosis, and acute bronchitis. In adults the mustard was mixed with an equal amount of wheat or other meal; in the case of children the combination was 1 part to 3 of the meal. Plasters were placed on the chest and the back, alternately, and were allowed to remain over night during the twenty-four hours. The remedy was well borne by the patients, and no serious burns were inflicted. In cases of pneumonia, influenza, and acute bronchitis mustard

was found to be an excellent substitute for morphine and other narcotics. In phthisis and pleurisy, it is a valuable adjuvant; smaller doses of the narcotic employed were sufficient to produce the desired effect. In relieving the cough the mustard improved the pulse and the respiration of phthisical cases.

MYALGIA. See RHEUMATISM and MUSCLES, SURGICAL DISEASES OF.

MYELITIS. See SPINAL CORD.

MYOCARDITIS.

Definition.—Myocarditis is a change in the heart-muscle, the character of which may be either inflammatory or degenerative, resulting in a diminished integrity of the tissue.

Varieties.—The disease may either be acute or chronic, local or diffuse. The acute and the chronic forms are so different in their origin and course that they seem more like two separate diseases than modifications of a single disease. In both, however, the important result from a clinical stand-point is the deterioration of the muscular fibre and consequent impairment of function.

Symptoms.—I. ACUTE MYOCARDITIS may have an abrupt onset; but it is more often insidious, merging itself with the symptoms of the primary disease, for acute myocarditis is always the result of some previous morbid condition. Its beginning may be attended by an increase of fever, or even a true rigor; the patient may complain of discomfort or pain in the cardiac region. The pulse becomes rapid and feeble; and, if an unfavorable course is taken, it subsequently grows weak and intermittent, and, toward a fatal termination, noticeably infrequent.

Parenchymatous myocarditis in children manifests itself by asystole, lasting some days to several months, without

change in the cardiac rhythm. Weill and Barjon (*Rev. Mens. des Mal. de l'Enfance*, Dec., '96).

In cases of myocarditis pressure on the region of the heart gives rise to a much more heightened activity of the heart and increased volume of the pulse than in healthy persons. De Renzi (*Rivista Clin. e Terap.*, No. 2, '97).

Dilatation ensues, as shown by a displacement of the apex-beat toward the left and an increase in the area of cardiac dullness. The first sound at the apex becomes feeble and indistinct; there may be heard at the same place a gallop-rhythm. At the base of the heart the pulmonic second sound may be accented and reduplicated. The general condition of the patient shows the stress of his illness, he lies prostrate in bed with pulmonary congestion, dyspnoea, increasing cyanosis, and perhaps coma or delirium.

The imperfect circulation may occasion a scanty and albuminous urine; enlargement of the liver, perhaps accompanied with catarrhal jaundice; and catarrh of the stomach, with vomiting. The condition thus sketched is not invariably present; milder attacks serve merely to aggravate the general weakness of the patient, and to delay, but scarcely to compromise his recovery.

Diagnosis is often difficult, as the condition gives rise to no pathognomonic signs. In general it may be said that breathlessness, precordial distress, and irregular pulse, in patients in middle life, are warnings that should be heeded, and which should be met by therapeutic measures. Bell (*Med. News*, May 7, 1904).

II. CHRONIC MYOCARDITIS. — This process varies greatly in rapidity. Some cases of this class may prove fatal so early as to make the term "chronic" seem inappropriate. Others progress slowly for a time, and terminate abruptly in unexpected death. Still others—and these are the majority—develop gradually and bring the patient to his end by a slow

process which may extend over many years. Cases are also found, post-mortem, which have not given rise to important symptoms even up to the time of death, to which event the change in the myocardium has not at all contributed.

When the process is gradual the symptoms are mainly those of diminished cardiac efficiency. There may be pain or uneasiness in the præcordium or attacks of true angina pectoris. Dyspnoea appears at first after some unusual muscular effort; it gradually becomes more marked, and may at last render the patient unable to utter more than a few words at a time without pausing for breath. Dyspnoea may also come on in a paroxysmal way, resembling attacks of asthma, and often described by the term "cardiac asthma." In early stages the pulse may be more frequent than in health, and of good strength or even somewhat more than normal tension. As the heart becomes more affected the pulse becomes weak, irregular, intermittent, and in many cases infrequent.

In this chronic form, also, as well as in acute myocarditis, the heart is apt to be enlarged, and the apex-beat may be displaced downward as well as outward. It is the rule to find dilatation of one or both ventricles; the left is more often the one affected. In some cases there is also more or less hypertrophy of the muscle-walls. The influence of muscular exertion upon the action of the heart is an important criterion of its integrity, and in suspected cases this test should never be omitted. The climbing of a single flight of stairs, for instance, may amply demonstrate the precarious condition of the circulation. The dilatation of the left ventricle often occasions relative insufficiency of the mitral valve, and a consequent murmur of mitral regurgitation heard at the apex, and transmitted

to the left axilla, with accentuation of the second pulmonic sound at the base of the heart. The heart's impulse may be extensive, but feeble in character, striking against the chest a quick, weak, blow. Sometimes, however, the apparently vigorous efforts of the heart are striking even when the radial pulse is feeble and ill sustained.

The brain being imperfectly supplied with blood, we may have such cerebral symptoms as vertigo, loss of memory, wakefulness, headache, delirium, and coma. The lungs may suffer from bronchial catarrh, œdema, or hydrothorax. The Cheyne-Stokes mode of respiration may be observed, especially near death. The digestive and renal changes may be the same as with the acute form of the disease. It is not only true that the urine is scanty under such conditions, but it is also deficient in the proportion of waste-products which it contains, the retention of which poisonous material in the system has been regarded as one cause of the asthmatic seizures already mentioned. The patient is also subject to attacks of syncope. These may be slowly recovered from, and even fatal. Again, death may occur during an attack of angina. In other cases death comes more gradually with the well-known symptoms of cardiac dilatation.

When certain common phenomena, particularly the sallow complexion, are present, one will not go wrong in assuming that the coronary arteries are implicated. The physical signs given by the heart are those of myocarditis alone, or of myocarditis plus hypertrophy or plus dilatation. The apex-beat will be displaced to the left, and the cardiac dullness will be somewhat increased. Quite early there is "gallop rhythm," a cantering or reduplication of the systolic sound. It is more commonly heard about the fourth rib, and is sometimes more marked in the supine position, and usually more marked after exercise. Myocarditis is often over-

looked in fevers because of the temporary disappearance of "gallop rhythm." Murmurs are not heard constantly until late in the disease unless complications are present. It is not so much the presence of reduplication, or of gallop rhythm, or of murmurs, as the variability of the auscultatory phenomena which is so characteristic of this pathological condition. When dilatation supervenes, the physical signs change in keeping with the physical condition of the heart. J. H. Musser (Med. Record, Jan. 27, 1900).

In infants and children myocarditis is mostly parenchymatous. Most intense and persistent myocardial changes are found after influenza and after diphtheria; they are most injurious at about puberty. In many arrhythmia and murmurs last for life; they may be modified by a protracted recumbent position during convalescence, and by resorting to absolute rest extending over weeks whenever increased cardiac disturbance is observed. The systolic murmur is extensive, but mostly heard in the mitral and pulmonary regions, at the same time that now and then there is an increase of transverse dullness. But more characteristic than the extensive murmur is the irregularity of the contraction of the heart. The condition of the heart-muscle changed by myocarditis (parenchymatous or hyperplastic, it makes no difference) is not uniform. No matter how many causes, either in the heart or nerves or distant organs, are charged with causing it, the most frequent cause is chronic myocarditis.

A peculiar form of arrhythmia mostly complicated with a murmur is the duplication of one of the heart-sounds. The cause of this gallop rhythm must be either in the myocardium or in the valves. From the improvement that rest alone is able to work on the case in regard to the annoying symptoms, there is no doubt that it is the former.

The gallop rhythm is a suspicious symptom, inasmuch as it proves the exhaustibility of the heart-muscle. Abraham Jacobi (Med. News, May 12, 1900).

Diagnosis.—Absolute certainty with regard to the existence or non-existence

of myocarditis in any particular patient is often difficult, if not impossible; and certainly any candid clinician who has had opportunities of comparing his ante-mortem diagnoses with post-mortem appearances will acknowledge the liability to error here. Fatty degeneration of the heart may give rise to many of the symptoms above enumerated; and it is often associated with arteriosclerosis; but it is rather less likely to cause angina pectoris. Moreover, the heart-sounds and the apex-beat are apt to be less distinct in fatty degeneration than in some instances of the disease under consideration. Absolute certainty in differentiating these two diseases is at present impossible.

Alcoholic drinks in any form may lead to myocarditis when used in excessive quantity. Proceeds very gradually; majority of patients well nourished and corpulent. Shortness of breath, pressure in præcordia, dyspnœa, and increase in the heart-dullness observed. Aufrecht (Deut. Archiv f. klin. Med., B. 54, H. 6, '95).

Valvular disease with failing compensation may produce a very similar symptom-complex. We have already seen that myocarditis may occasion mitral insufficiency; it may also be associated with aortic regurgitation, both conditions being associated with atheroma of the aorta. Furthermore, chronic myocarditis may exceptionally occasion narrowing of the tissues at the base of the heart in such a manner as to cause stenosis of the aorta or pulmonary artery. The right ventricle may dilate as well as the left, causing tricuspid regurgitation. Conversely, chronic valvular disease with failing compensation may give rise to chronic myocarditis. The main factors which would enable us to distinguish to some extent between the valvular and myocardial disease are: first, etiology; and, second, the history of the individual case. If a patient has no cardiac murmur whatever,

and yet presents other well-marked signs of cardiac disease, we are more justified in regarding the case as myocardial than as valvular; and yet severe mitral stenosis may exist without any audible murmur. The most characteristic symptoms of chronic myocarditis are: persistent slowness of the pulse, especially if associated with arrhythmia, angina pectoris, and sclerosis of the peripheral arteries.

Diagnosis of chronic myocarditis can often be made with certainty. The irregularity of the heart's action, the total loss of rhythm, is the characteristic feature of myocarditis, and is pathognomonic. In those other diseases the irregularity is always a late manifestation, and is due to an insufficiency of the heart-muscle that is secondary to other disease. In all other cardiac affections the regularity of the heart's action is restored as soon as digitalis or other heart-tonics have wrought their effect. Not so with myocarditis. Riegel (Zeit. f. klin. Med., B. 14, H. 4, '88).

[Personally, we are inclined to the belief that there is no single symptom which can be relied upon as a sure indication of myocarditis. Even disturbance in the coronary circulation may quite possibly cause as much cardiac failure in the nervous element as in the myocardial. The diagnosis must be negative rather than positive. Absence of the distinct evidences of valvular disease in connection with arrhythmical action of the heart becomes of itself a positive sign. A. L. LOOMIS and C. E. QUIMBY, Assoc. Eds., Annual, '89.]

Diagnostic criteria for distinguishing cases in which the morbid element is the muscular fibre, from the interstitial myocarditis which is part of the general arteriosclerotic process in cases evincing the vascular change: In the former the evidences of failure are largely limited to the heart; in the latter there is a more general affection of the organs and structures of the body. Lemoine (Nord Méd., May 6, '97).

If, in the course of an infectious disease in children there are attacks of faintness, pallor, vomiting, disturbed and

very irregular heart-action, a persistent distortion of the respiration and pulse ratio as in adherent pericardium, it is certainly significant, especially if these attacks have a tendency to recur. If examination of the heart shows extreme weakness of the apex-beat, weakness of the first sound, or disappearance of its muscular quality, greater intensity of the second sound at the apex, with intensification of the second sound at the pulmonary orifice, one certainly in these has danger-signals of greatest moment. If, in addition, as in pertussis, there are other signs of cardiac insufficiency, such as a slight systolic blow at the apex, œdema of the face and extremities, pallor and cyanosis, disinclination to exertion, and constant drowsiness, one should entertain the possible existence of serious degenerative changes in the heart-muscle. Henry Koplik (*Med. News*, Mar. 31, 1900).

Myocarditis is very liable to be mistaken for tuberculosis. It is well to remember, however, that there may be found a few bacilli in cases where there really is no tuberculosis. When attacks of angina occur, a mistake may be made in not recognizing the gravity of the trouble present. Such attacks, really due to myocarditis, are sometimes attributed to digestive disturbances for the reason that they are liable to take place after a meal. E. G. Janeway (*Boston Med. and Surg. Jour.*, July 26, 1900).

In persons beyond middle life who are the subjects of severe attacks of pain referable to the left shoulder and left breast, it is reasonable to suspect myocardiac disease, and such cases should be carefully investigated. Bishop (*Jour. Amer. Med. Assoc.*, Jan. 12, 1901).

In 100 autopsies in cases of cardiac disease, 32 were found dependent upon arteriosclerosis, and in only 4 was the weight of the heart under 400 grammes. The heart was enlarged in 16 instances. In 6 of the cases the history showed that the area of heart-dullness has been normal. In many the action had been weak and the heart markedly irregular and intermittent, the pulse following suit. Murmurs had been detected in 10, and in 7 of these the murmur was that of mitral

regurgitation; yet in none did a pathological condition account for the murmurs at the post-mortem examination. Henry Jackson (*Boston Med. and Surg. Jour.*, Apr. 4, 1901).

Etiology.—I. ACUTE MYOCARDITIS is always secondary to some infection: either through a perforating trauma or by means of the blood or by continuity of tissue. It complicates typhoid fever, scarlet fever, diphtheria, variola, cerebrospinal meningitis, pneumonia, influenza, malaria, rheumatism, and, in rare instances, tonsillitis. It may also be caused by sepsis, as in malignant endocarditis, puerperal fever, osteomyelitis, erysipelas, and gonorrhœa. In some instances the specific germs of these various infections are carried to the heart with the blood; this has been demonstrated in the case of typhoid fever, septic diseases, and gonorrhœa. There is also clinical reason to believe that myocarditis may be occasioned by the toxins of infectious diseases; and, indeed, this has been demonstrated experimentally in the lower animals.

Myocarditis in children occurs either as circumscribed patches throughout the organ or as a diffuse change. In such cases it is especially apt to depend upon some septic or infectious disease, as diphtheria and pyæmia. Steffen (*Jahrbuch f. Kinderh. u. phys. Erzie.*, B. 27, H. 3, '88).

Two fatal cases of myocarditis in the course of enteric fever. The first sound of the heart disappeared several days before death. Galliard (*Le Bull. Méd.*, June 17, '94).

In typhoid fever the highest grades of parenchymatous degeneration are reached by the end of the second week, and then slowly subside. Interstitial myocarditis usually begins at the end of the second week. In scarlet fever interstitial myocarditis begins as early as the fourth day; in diphtheria, about the seventh or ninth day; and in each it reaches its height about the end of the second week. Romberg (*Virchow's Archiv*, vol. cxxxiii, H. 2).

There exists in infants an acute parenchymatous myocarditis especially in the course of a chronic endocarditis. This myocarditis seems to be derived from an infection provoked by rheumatism and probably by other general diseases, certainly by erysipelas. It manifests itself by an asystole of from some days' to some months' duration. It is characterized symptomatically by the absence of all modification of the cardiac rhythm. Anatomically there exist a parenchymatous myositis with development of protoplasm at the expense of contractile substance, dissociation and thinning of the elementary fibrils, proliferation hypertrophy of the nuclei, and diminution of the muscular striæ, and absence of interstitial or vascular lesions. Weill and Barjon (*Rev. Mens. des Mal. de l'Enfance*, Dec., '96).

Myocardial changes are not at all infrequent complications of acute rheumatism; they account, in a great measure, for the variability in the severity of symptoms accompanying valvular lesions. Several acute cases of rheumatism in which the autopsies disclosed an advanced myocardial degeneration with very little endocardial change. T. Fisher (*Bristol Medico-Chir. Jour.*, Mar., 1900).

In pericarditis and endocarditis there is a superficial inflammation of the adjacent cardiac muscle.

II. The CHRONIC FORM of myocarditis sometimes ensues upon the acute process; it may develop as a result of venous stasis in advanced valvular disease, or in prolonged obstruction of the pulmonary circuit by chronic emphysema, fibroid phthisis, and pulmonary atelectasis. By far the most important cause, however, is arteriosclerosis, with which, therefore, its etiology coincides. Important influences favoring the development of both arteriosclerosis and chronic myocarditis are: heredity, the male sex, advanced life—over forty, chronic alcoholism, syphilis, gout, lead poisoning, chronic nephritis, severe muscular labor,

and excessive mental exertion or anxiety. So far as the volition of the individual is concerned, the etiology might, perhaps, be summed up in one word: "excess." The process is favored by cachectic conditions; for example, carcinoma, tuberculosis, inanition. The chronic process is a result of malnutrition of the myocardium. This may depend partially upon the poor quality of the blood-supply; but would seem to be very much more influenced by the amount of blood which flows through the cardiac vessels. Venous stasis diminishes the rapidity of flow in normal channels, arteriosclerosis diminishes the lumen of the arteries. An atheromatous plate may cover the origin of a coronary artery, or the artery may be narrowed by an hypertrophy and contraction of its coats; and thrombosis or embolism may completely obstruct it.

Causes which tend directly to some form of myocardial degeneration are: 1. Overwork. 2. Defective nerve-supply or control. 3. Deficient nutrition, from (a) disease or obstruction of vessels, (b) impoverished or poisonous blood. 4. Reflex vasomotor or sympathetic irritation (genito-urinary). 5. Limit of compensation. Bruce (*Practitioner*, Jan., '88).

[The causes of cardiac degeneration include all the causes of defective nutrition, either local or general, *i.e.*, (1) interference with the coronary circulation; (2) deficient or abnormal elements in the blood. Among the most prominent of these last is chronic Bright's disease. A. L. LOOMIS and C. E. QUIMBY, Assoc. Eds., *Annual*, '89.]

Certain cirrhotic conditions of the heart, usually attributed to ischæmia of that organ, are in reality due to chronic congestion. Pasquier (*Revue de Méd.*, Nov., '97).

Recent writers (Déhio, Radasewsky) describe a diffuse microscopical myofibro-sis affecting chiefly the auricles and associated with the most varied cardiac lesions of the heart, which is referred to excessive tension of the heart-walls. It

is found with various valvular lesions, emphysema, and interstitial nephritis, and may develop in persons as young as fifteen to thirty years of age.

Pathology.—I. ACUTE MYOCARDITIS.—There may be a diffuse purulent process affecting primarily the interstitial tissue and secondarily the muscles. This sometimes occurs in scarlet fever and also in other instances from unknown causes. Localized suppurations or abscesses are far more common and are due to infective emboli in the septic diseases mentioned before under ETIOLOGY. Broken-down muscle-fibre and bacteria are mixed with the pus in these abscesses. They may be as minute as the head of a pin or as large as a filbert. One was found to contain an ounce of matter. Later results of these abscesses are various. They burst into the pericardial sac and cause purulent pericarditis. If located in the septum they may open an abnormal communication between the heart's cavities. Rupturing through the base of the heart they may cause an abscess in the mediastinum. If situated in the walls of the ventricles they may discharge into one of the cavities of the heart and give rise to diffuse sepsis; or they may cause rupture of the ventricular wall, with sudden death from hæmorrhage; or finally they may, in very rare and fortunate instances, be absorbed and capsulated.

These purulent processes are almost invariably fatal. The ordinary infectious fevers, such as typhoid, pneumonia, and the like, above enumerated, do not occasion so grave disturbances. Between the muscular fibres are found leucocytes and proliferating nuclei, which may go on to form new connective tissue. The blood-vessels are enlarged and engorged. The muscular fibres are more or less affected. The nuclei may disappear, the striæ be-

come indistinct, and the fibres granular or even fatty. In limited areas there may be found associated with this parenchymatous degeneration, especially in the case of prolonged fevers, a hyaline change, the muscular fibres becoming swelled, homogeneous, and translucent, and their striæ very faint or entirely absent.

The degree of the parenchymatous myocarditis just described varies greatly in different cases. Its severity does not run parallel with the height of the fever, but bears a close relation to the virulence of the specific intoxication.

Cystic degeneration of the muscular fibres in a number of cases. This condition found most marked in the fibres of the papillary muscles of the left ventricle, though common in all other parts of the heart as well. The degree of the excavation varies exceedingly. The destructive process in its most extreme form removes the whole of the muscular substance from the centre of the fibre, no part of which, when examined with the microscope, will present the usual appearance, and even these may show the cross-markings characteristic of heart-muscle only in places. The muscle-nuclei often lie loosely in the cavities. A. V. Meigs (*Amer. Jour. Med. Sci.*, May, '92).

In a severe case of gonorrhœa the pericardium was universally thickened and swelled and contained numerous widely-dilated blood-vessels with thin walls.

The blood found in the pericardial cavity came from the rupture of these vessels. In some places, the lesions of the myocardium, although most intense near the endocardium, appeared to extend from the pericardium and could be traced directly to this. The muscular fibres showed various degrees of degeneration. In the slightest change they appeared slightly swelled, diffusely stained, their nuclei had disappeared, and they frequently contained vacuoles. There was every degree of change from this up to a total necrosis of the muscular fibres, and an entire substitution of areas of

purulent infiltration and necrosis for the normal tissue of the heart. Some of the areas of degeneration involved almost the entire thickness of the wall of the ventricle and auricle. Extensive hæmorrhage was found in some of the necrotic foci. Gonococci were found in the sections in considerable numbers. W. T. Councilman (Amer. Jour. Med. Sciences, Sept., '93).

In the early course of toxic diseases, sepsis, and cachectic conditions, acute parenchymatous myocarditis is more than apt to develop; should the toxæmia continue, the cloudy swelling usually develops into a fatty degeneration. Persons suffering from fatty or parenchymatous degeneration of the myocardium should have their blood-pressure watched very carefully, so that it may be kept low. Sudden cardiac exertion or sudden rise of blood pressure is prone, in especially fatty degeneration, to cause acute dilatation of the heart, resulting either in death or serious cardiac disease.

In all the autopsies of fatty degeneration and infiltration the valves were in a normal state; this is an important factor to be remembered in making diagnosis of cardiac lesions. Fatty hearts are normal or under size generally, and often are associated with atheromatous changes and cerebral apoplexy.

Nephritis or poor renal elimination is prone to produce fatty degenerative changes. Chronic diseases which cause interference with the proper oxidation of the blood produce fatty degeneration of the myocardium. Raymond Clark (Brooklyn Medical Journal, December, 1904).

The present prevailing conception of this acute infectious myocarditis is that the injury to the muscular fibre is the primary condition, and that the interstitial changes are a reactive inflammation, secondary to the disorganization of the muscle.

II. The CHRONIC FORM of myocarditis is generally regarded as merely a degenerative, and not an inflammatory, process.

Other names for it are chronic interstitial myocarditis; fibroid myocarditis; and fibroid infiltration, or cirrhosis, of the myocardium. Its most frequent causes are lesions of the coronary arteries. It may also be associated with chronic pericarditis and chronic endocarditis. Occasionally it is seen where none of these diseases exist. It may be comparatively diffuse or circumscribed, the parts most commonly affected being the left ventricle and the septum between the ventricles, and in these portions of the heart it is more marked near the apex than near the base.

It consists in a growth of new connective tissue between the muscular fibres, which latter atrophy and degenerate. The process may be one of very slow development, corresponding with slow diminution in the lumen of the corresponding artery, or it may begin abruptly as the result of embolism, or more frequently thrombosis, of the coronary artery or one of its branches. The anterior or left coronary artery is the one most apt to be diseased; hence the frequency of the change in the left ventricle.

When the lumen of the artery is suddenly closed, the portion of the heart dependent upon that artery for nutrition becomes necrotic.

The muscular fibre breaks down into granular *detritus*, and the connective tissue undergoes a retrograde metamorphosis; so that the affected portion becomes yellowish white or gray and of soft consistency. It may be also of a dark-red color from the blood and present the appearances of an hæmorrhagic infarction. This softened area of myomalacia may occasion rupture of the heart or acute inflammation; or it may be gradually absorbed and superseded by new connective tissue, which finally shrinks into a scar.

The portion of the heart affected by interstitial degeneration is thinner than normal. The remainder of the heart may become hypertrophied to a certain extent; finally, it is almost certain, if life is prolonged, to become dilated. The fibroid spot may be so situated as to make no great difference in the contour of the heart-wall, but, if situated toward the apex of the heart, it may yield to the tension of the contained blood and give rise to a cardiac aneurism. Such an aneurism may be found after death in cases where it has not greatly affected the health of the patient. Or, again, it may finally rupture and cause sudden death, or it may become so large as fatally to impede the activity of the heart. Furthermore, on the internal surfaces of cardiac aneurisms thrombi are apt to form, and these may give rise to embolic processes. In some cases the fibroid parts of the heart exhibit a calcareous deposit.

When chronic myocarditis is the result of pericarditis or endocarditis, the process is a diffuse one and superficial, involving the fibres adjacent to the inflamed membrane. As already stated, valvular disease of chronic pulmonary obstruction, in their terminal results of cardiac dilatation and venous stasis, may give rise to fibroid changes in the heart-muscle. These are more or less diffuse. They may demand careful microscopical examination in order to be detected, and their symptoms merge with and aggravate the effects of the original disorder.

Results of extensive studies upon the subject of fibroid degeneration and allied lesions, as relating to the heart and coronary arteries more particularly. A very sharp distinction must always be drawn between true atrophic fibroid degeneration and interstitial myocarditis; although similar in their results, they differ very markedly in their mode of production, and the former is the much more common lesion than the latter.

The influence of a morbid state of the coronary arteries must be taken into account in considering all diseases of the heart, but especially those of the myocardium, and no examination of the heart can be regarded as complete which does not include a careful investigation of the state of these vessels. Steven (*Lancet*, Dec. 24, '87).

In those cases of myocarditis characterized by œdema and dyspnœa the myocarditis is principally localized in the auricles. Arteriosclerosis is not by any means confined to the later years of life, and it is in these youthful cases of arterial disease that myocarditis is especially noted. This arteriosclerosis is sometimes noticed shortly after puberty, chiefly in males. It is commonly the result of various toxæmias, the most notable of which is, perhaps, that resulting from the use of tobacco. Then there are cases of hereditary myocarditis without any toxic element, occurring almost wholly in young males. J. Adler (*Med. Record*, Jan. 27, 1900).

Prognosis.—I. ACUTE MYOCARDITIS.—

Diffuse suppuration or abscess-formation is almost invariably fatal. The parenchymatous changes associated with infectious diseases aggravate the patient's malady and lessen his resistant powers, but they are of comparatively favorable prognosis. Undoubtedly very many more of such cases recover than die. As in many other conditions, recognition of the danger is of great advantage to the patient. The avoidance of undue exertion and the careful nursing and feeding of the sufferer contribute much to his safety.

The prognosis of acute rheumatic myocarditis is much more favorable than in case of endocarditis, for complete recovery follows, except in cases that are immediately fatal. In the acute condition death may occur in syncope. Peter (*La Sem. Méd.*, Mar. 14, '91).

II. CHRONIC FIBROID MYOCARDITIS.—

The prognosis varies with the abruptness and the extent of the degeneration.

Slow diminution of the lumen of a large branch of the coronary artery, even down to practical occlusion, may sometimes be endured by the heart without very marked embarrassment, whereas the thrombotic closure of the same vessel may result in immediate death; but between these two extreme instances are many degrees of disturbance. Minute patches of fibroid degeneration hardly affect the heart's activity. More diffuse changes, however, impair its functional ability. In particular, it proves unequal to any unusual demand upon it. Then, finally, even under ordinary conditions it can no longer maintain the circulation, and the signs of cardiac failure gradually develop.

The prognosis in an early stage of the process may be said also to depend in considerable degree upon the intelligence of the patient, his self-control, and his ability to fulfill the demands of treatment. The hard-drinking longshoreman beginning to break down under arteriosclerosis is sure to fail more rapidly than the fortunate individual who can withdraw from business activity and enjoy years of easy travel in Europe.

Treatment.—We have no efficient treatment for the acute suppurative form of myocarditis. Prophylaxis is desirable so far as it can be attained. For example, the writer would advocate in specific urethritis the administration of salol or some other antiseptic which is excreted with the urine. Whatever tends to cut short the original disease will lessen the chance of this secondary cardiac disturbance. It may possibly be that antistreptococcic serum, if injected, might aid in prophylaxis. Further than this the treatment can be merely supportive and stimulating. Where there is præcordial distress, hot applications may be made or a sinapism applied. Some

authors recommend ice-bags, but in view of the extreme feebleness of the patient it is a question whether cold might not prove depressing.

The acute parenchymatous form of myocarditis, associated with the infective fevers, does not demand essentially different treatment from that suitable for the original disease. What has already been said about external applications will apply in these cases also, and, if signs of cardiac embarrassment develop, the diet must be restricted and simplified and stimulants and heart-tonics exhibited. The patient should not be allowed to make any unnecessary efforts so long as the pulse remains irregular and intermittent. Death has more than once occurred as the result of sitting up suddenly in bed after prolonged fever.

Chronic myocarditis should be treated in the first place by removing or mitigating its causes, so far as possible. The patient's activities, both physical and mental, should be carefully limited and directed. The diet is of much importance, overfeeding and indulgence in alcoholic beverages being harmful. An exclusive milk diet will sometimes prove of great benefit. In any case, the amount of food taken at any one time should be rather moderate and the varieties such as are of easy digestion. In incipient cases moderate and regular exercise is beneficial. Sudden and violent exertion is harmful and may be dangerous, but walking on level ground or playing golf, or even riding the bicycle, if hill climbing is avoided, are proper. In less vigorous persons massage is of great value. The Nauheim system of medicated baths and resisted movements is excellent for properly-selected cases, and in some instances the results have been most fortunate.

With regard to drugs, iodide of potash in moderate doses, such as 10 grains three

times a day, if long-continued, may promote the nourishment of the heart. Iron and arsenic are also suitable tonics. If cardiac failure begins to show itself we must have recourse to tincture of digitalis, tincture of strophanthus, and sulphate of sparteine. Strychnine long continued in moderate doses may be of marked value in strengthening and regulating the heart. For cases where the amount of urine is very deficient diuretin sometimes works well. It may be given in divided doses to the amount of 60 to 90 grains in twenty-four hours.

Digitalis is of little use in chronic myocarditis, but bleeding to the extent of nine or twelve ounces is calculated to be beneficial by reducing the congestive state of the heart, which underlies the chronic myocarditis. Pasquier (*Revue de Méd.*, Nov., '97).

In myocarditis with gallop rhythm observed in children a long rest is required and attention to general hygiene, food in small and digestible quantities, and regulation of the bowels. In most cases iodide of potassium is indicated and strychnine or some other cardiac stimulant. Strychnine should not be feared, because it should not be forgotten that parts of the heart are probably in an intact or nearly intact condition, and permit of stimulation. If that be done carefully, the galloping rhythm ceases to be such a bad omen as some declare it to be. A. Jacobi (*Med. News*, May 12, 1900).

Morphine, administered hypodermically in small doses, together with strychnine and nitroglycerin, relied upon when there is apparently a condition of high arterial tension; when this is not present morphine and strychnine alone will tide over the difficulty until the danger is past. When there is venous stasis and lowered blood-pressure, the use of digitalis and ordinary stimulants will be sufficient to overcome the condition. Musser (*Jour. Amer. Med. Assoc.*, Jan. 11, 1902).

In the final stages the treatment is the same as in cardiac dilatation, to which

subject (see DILATATION OF THE HEART) the reader may refer. In most instances it is very unsatisfactory, the heart responding very imperfectly to any therapeutic appeals.

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MYOPIA.—Gr., *μύειν*, to close, and *ὄψ*, the eye. The term alludes to the partial closure of the lids to render vision less indistinct, by narrowing the circles of diffusion on the retina: an action of which myopes generally learn the benefit.

Definition.—That error of refraction in which the principal focus of the dioptric surfaces lies in front of the retina. Rays parallel when they enter the eye come to a focus in the vitreous, and diverge again, forming a circle of diffusion upon the retina. The eye is too long antero-posteriorly, as compared with the curve of its surfaces.

Symptoms.—The elongation of the eyeball may be part of its general enlargement in all directions, and in any case makes the front of the eye prominent, so that it looks large. In high myopia this elongation is very evident when the eye is turned strongly toward the nose. The pupil is often large and the anterior chamber deep. The expression of the patient is likely to be rather vacant. He is unable to perceive much of the facial expression of others, and hence does not learn to respond to it by facial movements of his own. All distant vision is indistinct; the myopic child, therefore, is at a disadvantage in many games; and is inclined toward reading and other amusements requiring only distinctness of near vision. The constant effort to bring the eyes near to the object looked at is likely to cause an habitual stoop.

Myopia of high degree is mostly attended by divergent strabismus. The elongation of the eyeball makes it very much harder to turn in its socket, and the limiting of the range of distinct vision to a near point compels the myope to converge his eyes more and more constantly than the normal. As the myopia increases, this need and difficulty of convergence increase, until the effort becomes too great to be habitually sustained and binocular vision is given up, and the worse eye allowed to squint. The process of elongation of the eyeball is, in the vast majority of cases, distinctly pathological and attended by changes in the coats of the eye, especially by disturbance and atrophy of the choroid in a crescentic area at the temporal side of the optic disk: the so-called myopic crescent. In high myopia the vitreous humor usually shows opacities and may be abnormally fluid, the crystalline lens is liable to become partly opaque, and the retina often becomes detached. Distant vision is always worse than near vision; but the latter may also be very imperfect. Excessive efforts of convergence may give rise to headache, vertigo, or the inflammatory symptoms of eye-strain.

Among 1240 cases of myopia 180 instances were found of the monolateral form of the disease. Corneal astigmatism is more common and exists in a higher degree in myopic than in non-myopic eyes, the frequency and degree of this astigmatism in myopes increasing with the degree of myopia. The monolateral type is not congenital in origin, traumatism and inflammation of the cornea being doubtless the cause of the condition in subjects already predisposed to myopia. Martin (Ann. d'Ocul., July, '94).

Analysis of over seventeen hundred cases of myopia recorded in private practice, showing that 7.6 per cent. exceeded 10 D. Among these it was rare to find vision above 0.4. In many instances it

was much less, while in four cases it reached $\frac{20}{30}$, and so continued during years. Circumoptical atrophy was common, and lesions at the macula presented themselves in varying degrees. H. D. Noyes (Archives of Ophth., July, '98).

Accommodation paralyses do not interfere so much with the vision of people with myopic eyes as of those with hypermetropic eyes. Out of 30,000 patients paralyses were noted in but 103 cases, bilateral in 75 patients. In the great majority of cases the ciliary muscle alone was paralyzed. The cause of the condition was found in all but 10 cases. These causes are divided by the writer into three groups, those due to some nervous disease, affecting the brain, cord, neuroses, or even some congenital condition; those due to the infectious diseases, including syphilis, tuberculosis, etc.; and those due to intoxication from drugs, food, ptomains. Helbron (Berliner klin. Wochen., Feb. 9, 1903).

Diagnosis.—Myopia is recognized and measured by: the improvement of vision by concave lenses, the weakest lens giving the best distant vision being the measure of the myopia; the blurred image in the direct method of ophthalmoscopic examination, rendered clear by a concave lens which corrects the myopia; and the reversal of movement by skiascopy, the distance of the point of reversal from the eye being the focal distance of the correcting lens.

Etiology, Pathology, and Varieties.—Myopia may be due to excessive curvature of the cornea, or crystalline lens,—*myopia of curvature*,—or to an increase of refractive power in the lens-substance,—*index myopia*; but the great majority of cases are due to elongation of the eyeball,—*axial myopia*. Myopia is often observed temporarily for a few weeks or months after an attack of iritis or iridocyclitis,—*inflammatory myopia*. This is probably due to alteration of curvature in the lens, although an alteration of in-

dex has been suggested. Prior to senile or diabetic cataract myopia may develop, probably by increased refractive index of the lens-nucleus. This change enables old people who have previously required convex lenses to read without them, and is therefore called "second sight." It is but a temporary benefit, and not an un-mixed good.

The mass of cases of myopia develop in eyes, not myopic at birth, from excessive strain of near-seeing. Heredity, bad hygienic surroundings, and impaired general health are predisposing causes. But the efficient exciting cause is excessive near work for the eyes. During near vision the eye-muscles are actively innervated, and the eyeball compressed laterally between them; so that there is a constant tendency to force it to elongate. The condition of congestion of the choroid and inflammatory softening of the sclera, that develops under excessive use of the eyes for near work, causes the sclera to give before the intra-ocular pressure; and permanent change in the shape of the eyeball results. As myopia increases, distant vision becomes less perfect, the range of clear vision more restricted, the efforts of convergence of the eyes greater and more constant; and at the same time the sclera is thinned by distension and less able to withstand the pressure of its contents. In this way the myopia tends to go from bad to worse, becomes "progressive"; and, when this progress has become so great that it cannot be checked, it is said to be "malignant myopia."

The idea has sometimes been entertained that use of the accommodation tended to increase myopia by increasing the intra-ocular tension; but this is directly disproved by both clinical and experimental studies of the subject. Many hypotheses have been advanced re-

garding myopia without any sufficient basis of facts, namely: that heredity acted by determining the proportions of the cranium or the shape of the orbits, or that a special diathetic or vascular condition was the chief determining factor in the case. The large number of myopic eyes that also exhibit considerable astigmatism make it probable that strain of the eyes from astigmatism, causing choroidal disturbance and scleral softening, is an important factor in many cases.

From an examination of the eyes of 3002 children attending some of the Aberdeenshire Board Schools, it was found that a large percentage (13.4) of myopia exists, especially in the school where education is pushed; while in the country-schools the percentage of myopia is small, never rising above 10 per cent. George Ferdinands (*Brit. Med. Jour.*, Sept. 12, '91).

From an examination of the eyes of over seven thousand school-children of Antwerp it was found that 2.13 per cent. were myopic. Before the age of 10 years 1.16 per cent. had myopia, 1.33 per cent. being boys and 0.99 per cent. girls. After the age of 10 years 3.10 per cent. were myopes: 3.88 among girls and 2.37 among boys. In well-lighted schools 1.63 per cent. of the scholars were found to be myopes, 1.74 per cent. being girls and 1.57 boys. In badly-lighted schools, 3.75 per cent. of the scholars were myopes; of these 4.83 per cent. were girls and 2.67 boys. Bad light and increasing age, with increased demands made upon the eyes by study, are powerful factors in the development and augmentation of myopia. De Mets (*Jour. d'Hygiene*, Sept. 15, '92).

Of 546 eyes examined between the period of infancy and six years of age, 24 were found to be myopic. The latter condition was found to increase very markedly between the thirteenth and twentieth years, when it became stationary. Herrnheiser (*Schmidt's Jahrbucher*, Mar. 15, '93).

The future of many myopic eyes depends on the way in which they are

used. Prolonged and habitual close work does harm. The effect is seen in overworked school-children, clerks, school-mistresses, literary men, seamstresses, jewelers, typesetters, and others. It is seen not only in the greater prevalence of complications among such persons, but in individual cases. Excessive close work in early life is often accompanied by rapid increase of refraction; in later life it often aggravates the graver complications. Patients who must, or will, continue such work in excess, especially those whose working distance is already too short and who decline to lengthen it by the aid of glasses, are encouraging their myopia to run a pernicious course. The amount of risk must be estimated from the grade of myopia, the age of the patient, and the amount of choroidal change already present. To give a bad prognosis, by way of warning, is sometimes the best or only way to prevent its fulfillment. Priestley Smith (*Ophthalmic Review*, Dec., 1901).

Treatment. — Myopia should be corrected by concave lenses, which should be worn constantly. For young persons the exact optical correction should be worn all the time; although in rare cases it may be better to use a weaker lens for a time for near work. Presbyopes will always require, for near seeing, a lens sufficiently weaker to make up for their presbyopia. The correcting lens gives the myope distinct vision and the visual range of the emmetropic eye; and places the check of accommodative effort upon the tendency to excessive convergence. Correcting lenses may be unsuitable for those cases in which binocular vision, and therefore strain of convergence, have previously been given up; or where the vision is so imperfect, or the mifying effect of the correcting lenses so great, that objects will still be held close to the eye to gain the benefit of larger retinal images.

The incomplete correction of myopia,

unless the glasses are so weak as to be of no material benefit, is extremely dangerous. By looking through such lenses obliquely the myope soon finds that he can see farther and more distinctly than by looking squarely through them; and he soon falls into the habit of looking obliquely. But looking obliquely through a lens the pencil of rays received by the eye is rendered astigmatic, and the evils of high uncorrected astigmatism are thus entailed. When the full correction for the myopia is worn, looking obliquely through the lenses makes vision worse and is instinctively avoided.

The wearing of correcting lenses enables the myope to reduce his efforts of convergence to nearer the normal. But there still remains the increased difficulty of turning an elongated eye in its socket. To help still farther, the amount of near work required of such eyes must be limited, and surrounded with the most favorable conditions, including the use of the best illumination and a correct posture, with frequent interruptions during which the eyes are permitted to rest on distant objects. These precautions are of the greatest importance during childhood and adolescence, when myopia begins and shows the most general tendency to increase.

Series of tables from observations based upon the results obtained from an examination of 200,000 formulæ for spectacles and eye-glasses in Philadelphia. The whole number of eyes for which distant glasses has been furnished by the optician was 187,018, of which 21.6 per cent. were for myopia. Of these, 39.5 per cent. were for simple myopia, while 60.5 per cent. were for myopic astigmatism. Among the private cases, however, where the refraction had been done under mydriasis, 22 per cent. were myopic; of these, 9.67 per cent. were instances of simple myopia, while 90.33 per cent. were astigmatic in varying degrees. In a very large number

of patients there was mixed astigmatism on one side, while on the other there was either simple or compound myopic astigmatism, similar pathological symptoms being present in both eyes. The percentage of myopia was 3 per cent. higher among private cases than among those selected from the books of the optical companies. The progress of the increasing refraction, both in percentage of cases and in the degree of the increase, was arrested by the treatment and glasses received. Risley (*Archives of Ophthalm.*, July, '94).

The prophylactic treatment of myopia consists in the following: 1. Making the patient employ the full correction of his myopia all the time and both for distant and near use. This is of prime importance in all varieties of myopia,—low, medium, and high,—and, if applied early, may check the progress of the myopia altogether. 2. Proper attention to illumination, the size and legibility of the print, the quality of paper used in the books read, the relative height and disposition of the seat and desk, and the many other factors that have been brought out by the zealous investigators into the subject of school-hygiene. These are important, but subsidiary, matters. 3. In low and medium myopia moderate restriction of near work or rather its better distribution, so that it is done mainly by daylight and not for too long at any one time. Furthermore, momentary rest of the eyes at frequent intervals during the work. These rules to be the more strictly enforced the higher the myopia and the younger the patient. 4. In high myopia with evidences of progress much more stringent restriction of near work. Open-air work to be encouraged and the adoption of confining and eye-taxing occupations forbidden. 5. In medium and especially in high myopia plenty of sleep and out-of-door exercise. 6. Re-examination of the patient at frequent intervals (which in the case of high myopia should be very frequent) to determine how much the myopia has increased. If it has increased, the glasses should be increased also up to the full strength, and the hygienic regulations above detailed mod-

ified accordingly. Alexander Duane (*New York Med. Jour.*, June 7, 1902).

The surgical treatment of myopia by removal of the crystalline lens is appropriate for a few cases of very high degree,—15 D. and upward,—in which correcting lenses give unsatisfactory results, although the eyes are capable of good vision. In children the removal is to be effected by a small discission of the lens, repeated several times, if necessary, until the absorption of the lens-substance leaves a clear pupil. In adults the lens may be extracted after a preliminary small discission to render it opaque. The operation is quite as formidable and dangerous as that of the removal of the opaque lens,—cataract. (See volume ii.) The removal of the crystalline will generally correct about 18 D. of myopia; and the higher the myopia, unless it be due to increased curvature of the cornea, the greater will be the effect of the operation. The removal of the crystalline also gives a larger retinal image than can be obtained through concave correcting lenses, with a correspondingly superior acuteness of vision. In cases suitable for this operation such improvement should amount to 50 or 60 per cent. After removal of the crystalline, although the patient is much less dependent on his glasses, they will still be necessary to secure the best vision; and different lenses will be required for near and far seeing, on account of the loss of all power of accommodation.

The extraction of the transparent lens is destined to hold its place in ophthalmic surgery as a means of treatment of high myopia where glasses do not afford proper assistance. Panas (*Arch. d'Ophthal.*, Feb., '97).

Operation does not benefit myopes having less than 11 D., while Schweigger's case of 33 D. is the highest thus far reported as having undergone operation. After removal of the lens there is noticed

a diminution of the myopia in most cases of from 16 to 13 dioptries, and this greater the higher the myopia. A myope of 7 D. may be found to have become hypermetropic 6.6 D.; and in Schweigger's patient there remained only 13 D. after the removal. A fluid vitreous or a choroidal atrophy is not found to contra-indicate, although it would be better not to interfere if a staphyloma should invade the macula. This procedure is especially applicable to children and young adults; but von Hippel and Sattler have been satisfied with their results in patients as old as sixty-four, and others have operated successfully on patients between the ages of thirty-five and fifty. Discussion, British Med. Assoc. (Boston Med. and Surg. Jour., Jan. 6, '98).

Fukala introduced the treatment of excessive myopia by the removal of the lens. The advantage of this kind of treatment is recognized, but its danger—loss of the eye from hæmorrhage and detachment of the retina—limits the indications to those in which the expected gain in sight greatly outweighed the risk. Herman Knapp (N. Y. Med. Jour., Jan. 8, '98).

Sixteen cases of extraction of crystalline lens in high myopia: Upward of fifteen dioptries; detachment of retina never met with, but marked improvement of vision never obtained. Simple extraction performed, all of the lens possible being removed. Three days later the wound is opened and remaining masses removed. Later, if necessary, the capsule is extracted. Vignes (Jour. of Ophth., Otol., and Laryn., Apr., '98).

One hundred and forty-two cases of extraction of crystalline lens in high myopia: Sight markedly improved in 85 per cent. Stationary in 10 per cent. Eye lost in 2 per cent. by infective and glaucomatous complications and in 3 per cent. by detachment of the retina. Darier (Jour. of Ophth., Otol., and Laryn., Apr., '98).

One hundred and sixty-two cases of extraction of crystalline lens in high myopia: Free crucial incision made in capsule with a very thin von Graefe knife. To remove lens a long, narrow blade used as a spatula. Loss of vitreous not feared, as very satisfactory results obtained after

it has occurred. Operation should not be performed when vision can be improved with glasses sufficiently to enable patient to work. Perfect emmetropia obtained in cases varying from 12 to 23 dioptries. Fukala (Jour. of Ophth., Otol., and Laryn., Apr., '98).

The removal of the crystalline lens for high degrees of myopia is warranted under the following conditions: The myopia should be of more than 15 D.; when no serious change is present in the retina; when the patient is under forty years of age. An eye should not be operated upon when the vision of the other eye is good. E. Fuchs (Wiener klin. Woch., Feb. 9, '99).

Immediate extraction preferred to dissection. The operation should not be undertaken before twelve years of age nor after forty, nor when there is good vision in one eye. Pierre Dolbeau (Gaz. Hebdom. de Méd. et de Chir., July 22, 1900).

Removal of the lens in a highly myopic eye causes a hyperopia of 15 to 20 dioptries, more than would be expected *a priori* if the corneal condition and length of the optic axis are not taken into account. It may be done where myopia is progressive or where it produces ocular weakness apart from the mere myopia, but it is a dangerous operation. Trousseau (Presse Méd., Dec. 2, 1903).

Sixty-three operations were performed on forty-four patients, all except one under forty years of age. The degree of myopia ranged from 10 to 28 D. The operation was successful in every case. In two cases detachment of the retina occurred at intervals of six months and one year following operation. The reporter observed that of 6324 myopic eyes occurring in half the number of his private patients, about 5 per cent. presented a myopia of more than 10 D. The method of operation in every case consisted of preliminary needling, followed by subsequent extraction of the disintegrated lens substance.

Increased tension, which occurs at two distinct stages, first, by reason of the swollen lens, and second, when

the pupil is free, or nearly so, of lens matter, was successfully met by paracentesis. The writer believes that within defined limits the removal of the crystalline lens for high degrees of myopia may now be regarded as a recognized and valuable method of treatment. He does not regard detachment of the retina as discrediting the method, considering that this is a danger which always menaces eyes affected with high myopia *per se*. Patients are usually extremely grateful for the relief the operation affords. Snell (British Med. Jour., Feb. 27, 1904).

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MYXŒDEMA.

Definition.—Myxœdema is a chronic functional disorder of cellular metabolism due to structural alteration of the thyroid body and inhibition of its physiological functions.

The disease was first described by Gull under the name of "cretinoid change" and subsequently by Ord under its present name.

Symptoms.—The most striking feature of myxœdema is a general alteration in the appearance of the patient. His body becomes more or less enlarged. The tissues are firm and resisting when struck, and, though they vibrate or shiver under lateral stroking, they do not pit on pressure. The swelling is usually irregular, being most marked in the face, neck, and supraclavicular spaces, and likewise variable in degree. The infiltration tends to vary with the intensity of other symptoms.

The swelling of the body is not always uniform or constant. It may, and usually does, appear most strongly in the face and supraclavicular regions. It may, however, be found in the limbs, or in the abdomen, before involving the face and neck. It may in early stages disappear altogether for a time, or it may be transferred from one region to another. The face is particularly subject

to alterations in the amount of swelling, generally in association with changes in symptoms, more especially nervous symptoms, disappearance being followed by headache or neuralgia, recurrence by relief of these conditions. William M. Ord (Brit. Med. Jour., Nov. 12, '98).

The abdominal walls being also thickened, the abdomen appears greatly enlarged and pendulous. The extremities are thickened and flattened, the hands being spade-like (Gull), the fingers blunt and sometimes square instead of round. As recently shown by Berkeley, the thickening may be limited to the scalp.

Eight cases in negroes in which the skin of the scalp was the seat of thickening, thus differing considerably in characteristics from the ordinary diffuse myxœdematous swelling of the skin in sporadic cretinism, or from the myxœdema acquired from thyroid changes in later life, yet presenting perfectly the local characteristics of the malady. No description found in either text-book or journal articles. H. J. Berkeley (Amer. Jour. of Insanity, Feb., '98).

Dryness and roughness of the skin is another marked feature of the disease. The surface is rough, rasp-like, especially over the hands and feet. In some parts, however, especially the face, the skin may be comparatively smooth, though dry. That of certain regions—the forehead, the eyelids, etc.—appears transparent and wax-like.

The physiognomy becomes coarse; the face is broad and expressionless; the mouth seems much enlarged, although the cyanosed lips are kept tightly pressed together, owing to greatly-increased thickness. The facial coloring is yellowish, and a circumscribed patch of redness is often present over the upper portion of the cheeks. The nose is cold, its tip being sometimes bluish; it appears flattened and broadened, through the thickening of the nostrils. The ears are also enlarged, thickened, and cyanosed, the

meatus being narrowed. The lids droop over the eyeballs, giving the patient an appearance of sleepiness. An effort to open the eyes is first manifested by elevation of the eyeballs. There is lacrymation and copious nasal secretion.

In Bright's disease there is a peculiar "sloppiness" of the conjunctivæ. In myxœdema the same condition prevails, but here it is due to the presence of mucin. When this symptom is noted, the urine should be examined, and, if no renal changes are present, myxœdema should be suspected. C. W. Chapman (*Lancet*, Sept. 30, '99).

The oral and naso-pharyngeal cavities are markedly involved. Pallor of their lining membrane is a noticeable feature. The lips are greatly thickened, and press against the teeth when the mouth is closed. The mucous membrane of the cheeks doing likewise, it is apt to project between the molars and be bitten. The tongue is generally enlarged and pale. The teeth become brittle and easily break off, or eventually fall out. The gums bleed easily; they are thickened and frequently ulcerated, especially in the neighborhood of the teeth, from which they tend to recede. The soft palate and uvula are thickened and translucent; the increase in weight causes them to press upon the base of the tongue and impairs their mobility. The mucous membrane of the nasal cavities, anterior and posterior, and that of the pharynx is also tumefied. Stubborn stomatitis with copious salivation and erosions and tumefaction of the laryngeal and tracheal tissues are sometimes observed and may cause death from suffocation. (Zielewicz, R. Kirk.)

The œsophagus, stomach, and intestines are also more or less infiltrated, gastro-intestinal disorders being thus induced, while the same changes in the rectum may give rise to obstinate consti-

pation (Ord, Combe). The appetite is poor; the patient dislikes meat and is never thirsty (Pel).

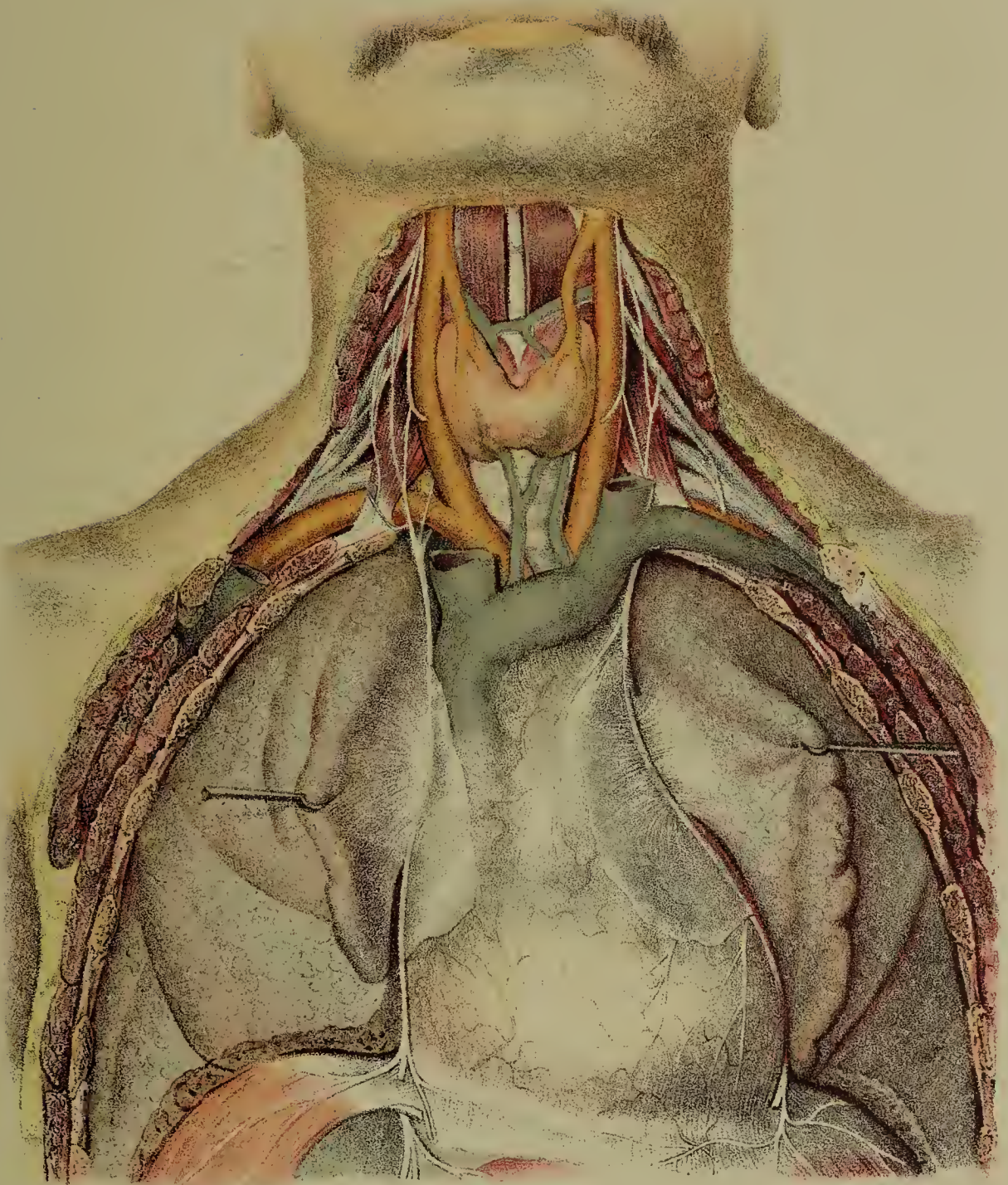
Epistaxis and bleeding at the gums, especially after the extraction of a tooth or as a result of slight injury, may prove severe. Intestinal and uterine hæmorrhages are also encountered, and may be quite profuse. Cerebral hæmorrhage is occasionally observed.

Three cases in which the tendency to hæmorrhage showed itself by frequent hæmoptysis. Arthur Davis (*Lancet*, Jan. 14, '88); Laycock (*Lancet*, Feb., '88).

Case of hæmorrhagic tendency in connection with the disease, the bleeding occurring from the lungs between menstrual periods. Maw (*Jour. of Laryn.*, June, '88).

Hæmorrhagic myxœdema with contractures, a new disease. The onset is sudden, with high fever, malaise, vomiting, headache, and the rapid appearance of typhoid phenomena, with great agitation at night. The delirium is often violent. The temperature-curve divides itself into three periods: 1. Rapid rise of the temperature to 39° C., the temperature remaining between 39° C. and 40° C. for from eight to ten days. 2. Apyrexia or even hypothermia for eight days. 3. The temperature again rises to 39° C. During the disease there is a general contracture of the muscles, especially those of the face and neck and the muscles of mastication. The skin becomes "malleable" like soft wax, and subcutaneous hæmorrhages in the form of ecchymoses, surrounded by a white, painful zone, appear in the third period of the disease. There is absence of meteorism and rose spots. The disease lasts from three to four months. The prognosis is grave. The cause has not yet been discovered. De Brun (*La Presse Méd.*, May 13, '96).

Speech, owing to the tumefaction of the mucous membrane and the general infiltration of the oral structures, is difficult. The motions of the palate, tongue, and lips being impeded, enunciation is



The physiological importance of the Thyroid Gland, as illustrated by its vascular relations.
Thick anterior venous network dissected off to expose the Gland.

imperfect, jerky, and explosive; the nasopharyngeal lumen being reduced, the voice is nasal, though at times the vocal sound is suddenly emitted through the nose. The vocal resonance is hollow, coarse, and leathery in tone. In women the voice may also be lowered in pitch and masculine.

The external genitalia are generally tumefied and the umbilicus sometimes projects as if it were a hernia.

The hair is lustreless, breaks easily, and assumes an appearance of coarseness and "fuzziness." It soon falls out, yielding easily to the traction accompanying the use of the comb. The brows, the lashes, and the hair of the remainder of the body may also gradually be lost. The nails are brittle and thin, and occasionally undergo complete atrophy.

Muscular weariness and exhaustion upon slight exertion form a marked symptom, though considerable strength may be temporarily shown, as in Charcot's case, the patient being capable of easily raising a sack of potatoes several feet. The head is supported with difficulty by the muscles of the neck, and when raised falls forward or backward with suddenness. The patient stands with difficulty and seems always about to fall, muscular quivering attending certain movements. A fibrillary tremor is often noticed. Paralysis is observed in about 9 per cent. of the cases.

The statistics of the Clinical Society of London show that in 109 cases of myxœdema there were only 14 cases of paralysis. Codd (*Brit. Med. Jour.*, May 4, '95).

Sensation is more or less diminished in intensity, especially where it is usually most delicate. The usefulness of the fingers is thus greatly reduced, touch becoming blunted and the motions of the joints stiffened. Small objects are held with difficulty and frequently dropped,

such small articles as pins and buttons being hardly felt. When the tumefaction of any region disappears, the sensibility returns.

Smell and taste are perverted, the patient complaining of foul odors when none exist or of sweet taste where none is warranted. Bitterness or acidity may also be anomalous features of the sense of taste.

The patient is often irritable and impatient, and may become violent late in the course of the disease. Fixed ideas are frequently noted, especially those involving suspicion. The attendants and friends are usually the main objects of the patient's mental perversions, their actions and words being misinterpreted. Though the patients are generally harmless to others, they may, through dread, inflict injury upon themselves. Headache is frequently complained of.

Delusions and hallucinations occur in nearly half the cases, generally when in an advanced stage. Insanity occurs in nearly the same proportion of cases: acute or chronic mania, dementia, or melancholia. Tremors and contractions of the hands and feet, similar to those observed in monkeys after removal of the thyroid, noticed in some cases. (Report of a Committee of the Clinical Society of London on Myxœdema, '89).

Case of myxœdema in a woman, 60 years of age, who developed delusions and hallucinations after thyroid treatment had been instituted for a short while. Although the treatment was discontinued, the mental excitement persisted and finally developed into acute mania, the patient dying within a few weeks. W. Wyllys (*Lancet*, May 11, 1901).

Case in a man of 41 years who showed, among other symptoms, mental excitement. Two days after his admission to the hospital he became so suspicious of his surroundings that he left the ward at night and was found by the police wandering about in his night-shirt. His delirium resembled that caused by alco-

hol. Rapid improvement of all symptoms followed the use of thyroid extract. R. H. Fitz (Boston Med. and Surg. Jour., May 16, 1901).

The various changes which take place in the mental condition of persons suffering from myxœdema are almost confined to the sphere of action. Either some toxin in the plasma surrounding the motor cells inhibits the chemical processes which originate a motor impulse or the absence of some substance from the blood interferes with the discharge. This toxin is neutralized or this essential substance is supplied by the administration of thyroid extract; the patients get well and remain well as long as they take thyroid. Welseley-Lewis (Lancet, Apr. 23, 1904).

A prominent symptom is mental torpor or slow intellection; apathy characterizing any effort in which the mind is used is sometimes only marked when the patient is first spoken to, however; in such cases, mental action, once started, seems to be arrested with difficulty; the patients talk with more than normal volubility. Speech may become animated and violent under the influence of anger (Thaon). The memory is usually very defective.

Vertigo is sometimes complained of, and the patient may fall when his eyes are closed. Locomotion is tentative, sometimes waddling, missteps being frequent and sometimes induced by slight obstacles. The ataxic gait has also been noted by Hammond. The motions of the arms are also unsteady and uncertain.

The oral or rectal temperature is lowered from 1° to 3° F. when intercurrent affections involving pyrexia are not present. Cold produces its usual effects more readily than in normal individuals, the extremities and the lips becoming blue under the influence of slight cold. The sensation of cold is not experienced, however, owing to the diminished sensitiveness of the skin.

The flow of urine is decreased, and its specific gravity is usually about 1010. The proportion of urea excreted is sometimes reduced to less than one-half of the normal ratio. Albuminuria may occur as a result of the pressure due to infiltration of the tissues surrounding the tubules and Malpighian bodies; hence only when the disease is somewhat advanced. Glycosuria has also been observed in some cases. Tissue metabolism is markedly reduced, as shown by the decrease of urea and uric acid in the secretions.

The abdominal viscera, heart, liver, lungs, etc., do not seem to be involved in the process, unless some intercurrent disease of either of them appears. The lungs, however, are especially liable to tuberculosis.

The duration of myxœdema when untreated varies from six to twenty years (Combe). It is characterized by periods of amelioration sometimes of considerable duration, after which the patient relapses into his former state—with perhaps slight increase in the intensity of the symptoms. These exacerbations occur more or less frequently and the patient finally dies of exhaustion. This termination of the disease is infrequent, however, the patient being usually carried off by an intercurrent affection.

ANOMALOUS FORMS.—All the main symptoms enumerated may suddenly appear as a temporary complication of goitre. This acute form of myxœdema may also present symptoms of toxæmia and sometimes proves promptly fatal. In a case reported by Lloyd the disease lasted only a few days.

Case of acute myxœdema, with tachycardia, glycosuria, melæna, mania, and death, showing that acute myxœdema may occur as a temporary condition in goitre, giving rise to a group of symptoms which, so far, seem not to have been recorded. It seems most rational

to suppose that in this case there was a perversion of the function of the thyroid gland, resulting in a toxæmia, which presented some of the features of myxœdema and some of Graves's disease with mania. Osler (*Jour. of Nerv. and Mental Dis.*, Feb., '99).

Again, there are cases in which but a limited number—even two or one—of the symptoms enumerated appear. The menopause, according to Chantemesse and Marie, is an instance of the anomalous form, and due to the abnormal manner in which the functions of the thyroid gland are performed during this period.

The etiological influence of antecedent disease in the patient, especially infectious disorders, is marked. Rheumatism, erysipelas, malaria, and tuberculosis are frequently cited among the morbid antecedents, but they seemed sometimes to immediately precede the development of the disease (Combe).

Differential Diagnosis.—When all the main symptoms outlined are present, diagnosis is not difficult; the increase in bulk, the hard swelling, the dryness and roughness of the skin, the mental apathy, the loss of hair, the peculiar yellowish color, and the hypothermia are quite characteristic. In some cases, however, but a few of these signs may be present.

EXOPHTHALMIC GOITRE.—This disease may precede myxœdema, and its symptoms may therefore appear along with those of the latter malady. Individually, however, exophthalmic goitre differs so markedly from myxœdema as to render an error unwarranted.

NEPHRITIS.—The œdema of this affection is most marked in the face and dependent parts. There is pitting on pressure, which is not the case in myxœdema. The skin is not scaly and dry and the nutrition of the hair is normal. In nephritis the patient is normal mentally.

In myxœdema the swelling affects the forehead, the upper as well as the lower eyelid, the bridge of the nose, the lips, and tongue, differing from acute nephritis; it is most intense over the masseters and in the supraclavicular spaces, which are rarely affected in nephritis. In granular kidney the œdema only affects the ankles and legs after standing, and is not very well marked. In myxœdema there is usually depression of temperature, which is rare in nephritis and other diseases; this is also accompanied by a subjective feeling of cold. M. Allen Starr (*Med. News*, Dec. 15, 22, '94).

The character of the œdema is entirely different from that encountered in nephritis; it does not pit on pressure, and cannot be removed by massage. Especially characteristic of myxœdema is the swelling in the supraclavicular region noted by Hilton Fagg in cretins. The stupid cretinoid appearance of patients with myxœdema is characteristic. S. J. Meltzer (*Med. Age*, Mar. 10, '96).

There are instances in which the diagnosis is by no means easy. Case of a married woman, aged 44 years, with 10 children, who had always had excellent health. Ever since puberty she had a tendency to swelling of the feet, particularly at night. For a year or more she had been getting pale and heavier, the face a little swelled and flabby, and the eyelids œdematous in the morning. Pale-yellow, very muddy complexion; skin dry; but the broad features characteristic of the myxœdematous facies absent. No folds of skin on the forehead; neck not swelled; no large supraclavicular pads; the thyroid gland could be felt. Legs swelled, particularly below the calves. No pitting as in ordinary œdema. No change in voice. Very despondent and low-spirited. Pulse, 70; no increase in tension. Temperature, 98.5°. Amount of urine normal; color also; specific gravity, 1017; trace of albumin; no tube-casts. Case regarded as one of Bright's disease, but suggestive of myxœdema. Under thyroid extract marked improvement. If she omits it for a few weeks the swelling returns. Her disposition became quite natural again, and

has remained so. William Osler (*Montreal Med. Jour.*, Feb., '97).

Etiology.—Myxœdema was at first believed to be limited to women, but the statistics of the Clinical Society Commission added to those of Hun have shown that it was also prevalent among men to the extent of about 25 per cent. The predilection of women to the disease was ascribed by the latter author to the fact that the thyroid, being functionally more active, is more liable to degenerative changes. Among the 95 women recorded in his statistics, 64 were married and had had 300 children and 29 abortions. Disorders of menstruation attended by copious, repeated hæmorrhages may act as predisposing factors.

Cold and damp seem to predispose the organism to the development of myxœdema, while cases have been known to recover by a change of residence to a warm country (Charcot). On the other hand, exacerbations of the disease seem to be associated with the approach of winter (Morvan), and cold is notably unfavorable to the progress of the affection at any time. It has been observed in countries typifying the various climates, including Italy and Spain, but England is by far the country in which it is most frequently met with.

Heredity seems to bear some influence in the production of myxœdema. Cases in which symptoms distinctly suggested the existence of myxœdema in parents have been reported by Taylor and Ridet-Saillard. Parental alcoholism, neuroses, tuberculosis, cancer, arthritism or its manifestations, asthma, rheumatism, etc., have been found to an unusual extent in the history of the cases reported.

There is strong evidence that myxœdema, sporadic and endemic cretinism, cachexia strumipriva, and the operative myxœdema of animals are severally species of one genus, and that the one

pathological factor common to all these conditions is the occurrence of morbid processes or of operations involving the annihilation of the function of the thyroid body. Ord (Report of a Committee of the Clinical Soc. of London on Myxœdema, '89).

In at least 10 per cent. of the cases collected that occurred in men several seemed to be hereditary. A certain number were preceded by hypertrophy of the thyroid, which disappeared later. Ord (*Med. Record*, Sept. 13, '90).

Case of myxœdema coming on after long-continued use of iodide of potassium for another affection. Such a sequence is interesting, considering the supposed virtue of iodine in some form in thyroid enlargement. A. M. Stalker (*Lancet*, Jan. 10, '91).

Case of myxœdema in a man, aged 36 years, in whom the administration of potassium iodide, 10 grains, to relieve some sacral pain, caused dangerous symptoms. The lymphatic glands of the neck were swelled, the eyelids were œdematous, and the patient complained of a sensation of impending dissolution. The symptoms subsided in two days. Potassium iodide might possibly have accelerated the progress of an incipient myxœdema. Connal (*Glasgow Med. Jour.*, Oct., '98).

Case of myxœdema whose mother had suffered during twenty-three years from a malady resembling the patient's. A sister is similarly afflicted, and a brother, now dead, had a like trouble. E. H. Small (*Med. Review*, Oct. 14, '99).

Violent emotions and sorrow have been adduced as prolific etiological factors by Pel.

Pathogenesis.—Complete removal of the thyroid gland, as previously stated (see *ANIMAL EXTRACTS*, volume i), is followed by symptoms similar to those observed in myxœdema: a fact first recorded by J. L. Reverdin, of Geneva. On the other hand, the internal administration of thyroid extract, as is well known, promptly causes the symptoms of this disease to disappear. That myxœdema,

therefore, is due to suppression or impairment of the functions of the gland seems obvious.

With very rare exceptions there is discoverable a well-marked atrophy of the thyroid. About this all pathologists are agreed. I can find no example of autopsies upon cases diagnosed clinically as myxœdema in which the gland was found normal or but little affected. J. George Adami (Trans. Congress Amer. Phys. and Surgs., May 4-6, '97).

Myxœdema in common with sporadic cretinism of children and cachexia strumipriva is dependent on a loss of function of the thyroid gland. Ord (Brit. Med. Jour., Nov. 12, '98).

Such being the case, the etiological factors enumerated should in reality be considered in the light of agencies capable of inducing morbid changes in the gland itself, which changes constitute the primary subjective feature of each case. Myxœdema thus becomes a symptom-complex resulting from impairment of the functions of the thyroid gland through local disease.

[This is the only conclusion warranted by our present knowledge, all other conceptions of the pathogenesis of the disease failing in one direction or another.

A few of the theories advanced, however, satisfied many of the obscure features of the disease. Hadden based on the diminution of the urea ratio and the hypothermia the theory that the vasomotor system was mainly at fault. This view was sustained by Morvan, who attributed the paralysis and œdema mainly to the influence of cold and damp, a neuromyopathy being the primary morbid condition. Prolonged lymphatic angiospasm was supposed by Hadden to prevent the return of various elements into the circulation. Connective-tissue changes, reduction of the urea and uric-acid elimination thus became a normal result, with nervous manifestations and hypothermia as attendant symptoms and atrophy of the thyroid as one of the main sequels.

Henrot attributed myxœdema to hypertrophy of the pituitary body and of

the pineal gland involving secondarily the sympathetic, this theory being based upon Tiedemann's view that the pituitary body affords an anastomosis between the two main neighboring ganglia of the sympathetic, and upon the fact that in reptiles and fishes, in which mucous tissue abounds, the pineal gland and pituitary body are markedly developed. The cutaneous infiltration with mucin was thus explained. This is, to a degree, sustained by the cases of J. Stewart, alluded to by Adami, in which autopsy disclosed a large cancerous tumor of the pituitary, the thyroid being normal. But the only manifestation of the disease seems to have been a myxœdematous swelling of the hands and of other regions to a less extent. Goodhart accounted for all the nervous and mental manifestations by supposing the existence of a cerebral lesion, the nervous elements undergoing changes corresponding to those observed elsewhere in the organism. Charcot gave the disease the name of *cachexie pachydermique*, under the belief that it bore a certain kinship with elephantiasis due to impaired nutrition of the nervous system. All these conceptions found many able supporters.

The most prominent and perhaps the only dissentors from the prevailing views in respect to the physiological effects of athyroidism are Professor Munk, of Berlin, and R. H. Cunningham.

Munk (Virchow's Archives; Ther. Gaz., Jan. 15, '98) absolutely denies that the removal of the thyroid in animals either necessarily causes death or inevitably leads to myxœdema, having never seen myxœdema develop in animals. He contends that the feeding of thyroid or the ingrafting of the removed gland into another part of the body never lessens the dangers of thyroidectomy, which always remains a serious operation. He kept a number of animals alive after the operation, and has been successful in the case of apes that have survived, and are in good health nearly a year after the careful, complete, but thoroughly aseptic, removal of the supposedly absolutely essential thyroid. This view coincides with that of Lanz (Boston Med. and

Surg. Jour., Oct. 17, '95), who saw in thyroidism two component causes: (1) a poisoning from absorption of putrid material; (2) a specific effect of the thyroid gland *per se*.

Cunningham (Jour. of Exper. Med., No. 2, p. 147, '98) after a careful review of the literature and a series of experiments, argues that the symptoms of induced thyroidism are manifestations of an intoxication resulting from the ingestion of decomposed thyroid material. The so-called experimental thyroidism is not, he contends, specific for the thyroid only, for the ingestion of many substances derived from animal tissues other than the thyroid gland may produce an intoxication strikingly similar in every respect to that of experimental thyroidism.

While the toxic effects noted might furnish some ground for Cunningham's views, he will find it difficult to explain how this decomposed thyroid material can, administered therapeutically, cause the disappearance of morbid conditions and all the symptoms attending myxœdema. CHARLES E. DE M. SAJOUS.]

In all cases in which the diagnosis of myxœdema was unmistakable, and in which the thyroid, or what remained of it, was histologically examined, its functions were found markedly compromised by local morbid processes of various kinds. Adami, in a study of the literature of the subject, ascertained that in the majority of cases the atrophy was "peculiarly extensive, the specific cells of the gland being replaced by fibrous tissue." In some, less advanced, there were not only degenerated remains of vesicular epithelium, "but of vesicles which by the superabundant proliferation of their epithelium would seem to be undergoing a compensatory hypertrophy,"—an effort to restore a function exemplified in other directions.

Case of a woman, 26 years old, who had thickening of the skin, falling of hair, atrophy of the thyroid gland and other organs peculiar to myxœdema,

while simultaneously there was a very rapid pulse, difficult breathing, exophthalmos, and the sweating peculiar to exophthalmic goitre. The typical symptoms of both diseases being present, the thyroid theory of the origin of myxœdema seems to be unlikely. Jolly (Jour. Amer. Med. Assoc., Apr. 15, '99).

Among the disorders to which atrophy of the thyroid have been traced, according to Combe, are acute articular rheumatism (Hadden), erysipelas (Mendel), syphilis (Koehler, Pospieloff), and actinomycosis (Koehler). To this list may be added malignant neoplasms, several instances of which have been recorded.

Acute inflammation of the thyroid may induce infantile myxœdema, followed in turn by more or less complete atrophy of the gland. It is therefore probable that a certain proportion of myxœdema in the adult could be traced to this cause.

Myxœdema is a symptom or combination of symptoms of loss of the function of the thyroid gland. In the idiopathic form it is a symptom of chronic interstitial thyroiditis, just as anasarca may be a symptom of renal disease or ascites of hepatic disease. G. R. Murray (Brit. Med. Jour., Feb. 8, '96).

[It is possible that the thyroid enlargement reported as preceding myxœdema in some cases would be found to have been due to a thyroiditis occurring in arthritic individuals. As stated under ETIOLOGY, a proportion of cases of myxœdema show an ancestral history of rheumatism, asthma, etc., and other manifestations of arthritism. CHARLES E. DE M. SAJOUS.]

Case of cretinism following an attack of acute thyroiditis. The child was well and normally developed until 10 months of age, when she had the attack of acute thyroiditis. The latter lasted about a week; was accompanied by fever, swelling of the thyroid, and symptoms of pressure on the trachea. The throat was normal in appearance on the inside. There was no abscess-formation; the swelling and fever disappeared with complete atrophy of the thyroid. The

child's growth and development ceased immediately after this attack, and she developed the usual appearance of a typical cretin. Treated for a short time with thyroid extract with marked improvement. Edmund Shields (N. Y. Med. Jour., Oct. 9, '98).

Thyroidal fibrosis is sometimes preceded by exophthalmic goitre.

Case of a female in whom, at the age of 17, was noticed enlargement of the throat and prominence of the eyeballs, with hurried, jerky manner both in speech and movements. This condition seems to have persisted to the age of 21, when with the appearance of the catamenia the health became normal. Within a year of this symptoms of myxœdema supervened, and when seen at the age of 26 the latter were well developed and the thyroid gland imperceptible. A normal state of health returned after five months' treatment with dry sheep's thyroid.

The patient's paternal grandfather and paternal aunt, her maternal grandfather, and two uncles had died of "dropsy." Her father had died of endocarditis; one of two brothers suffered from rheumatism and alopecia. T. F. Hugh Smith (Brit. Med. Jour., Jan. 4, '96).

In certain well-observed cases the symptoms presented before the establishment of myxœdema have been more or less the symptoms of exophthalmic goitre. It appears to me probable that we shall recognize in the near future more and more the occurrence of a stage of hypertrophy of the thyroid gland with or without the signs of Graves's disease as an antecedent of myxœdema. William M. Ord (Brit. Med. Jour., Nov. 12, '98).

Two cases of myxœdema, in which the pituitary body showed complete loss of glandular substance and induration of the stroma. The resemblance of the changes to those found in the thyroid gland was most striking. As advanced morbid changes are often found in the pituitary body while a large portion of the thyroid gland is still intact, it seems probable that the myxœdemic changes may have begun in the hypophysis. Pon-

fick (Zeit. f. klin. Med., B. 38, H. 1, 1900).

Atrophy of the thyroid gland being accepted as the primary factor, how are the morbid changes in the various organs involved in myxœdema brought about?

That we are dealing with the results of inhibited physiological function is sustained on all sides.

Where glands afford an internal secretion the development or non-development of symptoms of disease depends primarily upon the relative amount of internal secretion produced and of the substance or substances acted upon by the same. J. George Adami (Trans. Amer. Phys. and Surgs., vol. iv, p. 115, '97).

The thyroid tissues, as shown by Baumann, contain a substance, thyro-iodine, that is unaffected by boiling, strong acids, or gastric digestion, and which, when absorbed into the general organism through the blood- or lymph- channels, counteracts all the symptoms of myxœdema, or "thyroidism." The precise effects of this substance is, in the light of prevailing views, that it antagonizes noxious products of metabolism or that it so enhances metabolic interchanges as to keep them to a normal standard.

The latter view seems satisfactory, though the predilection for certain tissues—the skin, the nervous system, etc.—remains unexplained. Still, many anomalous manifestations attending the therapeutic use of thyroid would thus be accounted for. The gouty and rheumatic manifestations—noted particularly by Crary, Witherstine, Harris, and Wood, for instance—would normally be ascribable to a sudden onslaught of products of metabolism into predisposed regions.

Case of a man who, immediately after he was put on thyroid extract, had a typical attack of gout, which subsided when the extract was stopped, and reappeared when the extract was again administered. The last previous attack

of gout had been three years before. The thyroid extract, by producing increased metabolism, might account for the attack of gout, despite the fact that usually in myxœdema the amount of urea excreted is largely increased by the use of thyroid preparations. Patients taking thyroid preparations complain of a good deal of pain in the back or limbs; it is worthy of consideration whether those pains might not be of a gouty nature. Thomas Harris (*Brit. Med. Jour.*, Feb. 15, '96).

Again, the growth of hair, the increased assimilation of fat, the improved appetite with increased absorption of nitrogenous foods, the skeletal growth, and the general improvement of nutrition witnessed when thyroid is used remedially remain unaccounted for if it is the thyroid gland's function to eliminate toxic products of metabolism.

The group of symptoms "indicating in various ways impairment of the functions of the nervous system, such as slowness in muscular movement and tardiness in response to impressions made upon the surface of the body, slowness in thought and action, weakening of memory, etc.," Ord attributes in part to alteration in and around nerve-endings, due mainly to pressure of the connective tissue and the alterations in the latter. That this view is based on good ground seems probable, though it fails to account for the complete (though not final) recovery witnessed in even advanced cases.

Results of the examination of the brain in a typical case of myxœdema with marked mental symptoms: Brain slightly œdematous; slight, diffuse, atrophic condition of the convolutions. Sections taken from a point one inch from the upper end of the ascending frontal convolution showed a marked abnormality in the nerve-cells, consisting of a tendency to distortion and diminution of the number of processes. The nuclei were inflated, distorted, and vacuolated. In some cases the cells had disappeared, leaving only the distorted

nucleus. This condition might account for some of the mental, motor, and sensory phenomena of the disease. J. R. Whitwell (*Brit. Med. Jour.*, Feb. 27, '92).

Myxœdema is a symptom-complex, but it may be considered as a special type of diabetes in which the primary lesion is situated in the thyroid gland, the secondary pathological changes affecting the nerve-centres and all other tissues of the body. Nicola Dominicis (*Gaz. Inter. di Med. Pratica*, Feb. 28, 1900).

My own interpretation of the pathology of myxœdema differs from those herein submitted, which are intended to portray accepted doctrines only.

Treatment.—The treatment of myxœdema by thyroid extract, the only remedy that has proved efficacious, is given in detail in the article on ANIMAL EXTRACTS (volume i), and the reader is therefore referred to that section.

Two cases of typical myxœdema in one of which desiccated thyroids were used, while in the other iodothylin was given. Iodothylin produced very much less disagreeable after-effects than did thyroid tabules, while the results as to effects upon the myxœdematous process and the general nutritional influences were similar. Sidney Kuh (*Phila. Med. Jour.*, Apr. 8, '99).

Case of congenital myxœdema, in a girl of 17, in which marked improvement followed the use of thyroid-gland extract. On one occasion the thyroid was intermitted, and the symptoms of cretinism began to return. It became evident that the thyroid treatment would have to be resorted to permanently. Sklarek (*Berliner klin. Woch.*, Apr. 17, '99).

Murray in a recent paper (*Lancet*, Mar. 11, '99) stated that he had found the liquor thyroidei (now official in Great Britain) preferable to the dry extracts. From $\frac{1}{8}$ to $\frac{1}{4}$ of a lobe of sheep's thyroid represents about 10 minims of the liquor. Being prepared from a large number of glands, its strength is uniform. The dose recommended—5 to 10 minims

—he prefers to administer in a single daily dose at bed-time.

[This is a wise precaution, since the deleterious effects are most likely to occur during active exercise. I have seen two cases, in which I have administered thyroid extract (for disorders other than myxœdema) in 2-grain doses three times daily, suffer from attacks of vertigo and syncope, which only occurred while the patients were walking or climbing stairs without undue exertion.

Dr. Murray was led to realize the import of great care by painful experience in two cases, in which death occurred from syncope. The patients suffered from cardiac disease, and the fatal results had been brought on owing to too early exercise after prolonged treatment for myxœdema. CHARLES E. DE M. SAJOURS.]

Great caution is required in the use of this potent agent. Murray particularly warns against its reckless use in cases showing symptoms of degeneration, particularly when attacks of syncope, dyspnœa on exertion, feeble or irregular pulse, or weak heart-sounds are elicited by the examination. Under these conditions the patient should be confined to bed at first and only small doses of from 3 to 5 minims of the liquor thyroidei (equal to about 1 to 3 grains of our extract) given each night. This dose he found to be well borne and may gradually be increased to 10 minims. Unless confined to bed, the cases are apt to ignore their cardiac weakness and utilize their returning vigor too early, thus imposing upon the heart labor before it has had time to adapt itself to the altered conditions brought about by the treatment. Any undue acceleration of the pulse, up to 90 or 100, indicates a reduction in the dose, and any signs of cardiac

failure must be met by stimulants and digitalis.

[Doubtless this advice is based upon Dr. Murray's experience, and should be followed. Still, it does not appear to me to be sustained by the prevailing theory as to the physiological rôle of the thyroid. If, when administered remedially, it also stimulates metabolism, the cardiac complications are the result of overstimulation. If such is the case, digitalis and stimulants would apparently increase the danger. On the whole, the necessity of precautionary measures in the use of the remedy is all the more emphasized. CHARLES E. DE M. SAJOURS.]

Myxœdema being due to the absence of some thyroidal principle possessed of physiological functions, it is obvious that the use of thyroid as a remedy must be continued after a cure is obtained. Small doses are sufficient to preserve health, and recurrence may be predicted unless these are taken.

Next in importance to thyroid extract is warmth. Patients are invariably improved by warm weather, and this indication should be taken as guide in respect to dress, bed-covering, etc. Warm baths have also proved very beneficial.

Various remedies—quinine, strychnine, iron, ergot, etc.—were employed before the use of thyroid extract was proved curative by Murray; but, as they were practically useless, even their enumeration seems superfluous.

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Philadelphia.

MYXOMA. See TUMORS.

MYXOMATA, NASAL. See NASAL CAVITIES.

MYXOSARCOMA. See TUMORS.

N

NÆVUS. See TUMORS, and SKIN, SURGICAL DISEASES OF.

NAILS, DISEASES AND INJURIES OF THE.

Besides the implication of the nail in general morbid processes—such as syphilis, neuritis, leprosy, etc.—there are several strictly local divisions that require special notice.

Contusion.

Contusion of a nail by a blow, a compression, etc., is a common occurrence. Unless sufficiently marked to cause destruction of the matrix, such an injury is usually slight, the acute pain experienced at first quickly disappearing. When, however, the traumatism is serious and the nail is torn off, severe suffering is induced, which may persist quite a long time. Again, infection of the exposed tissues may occur, leading to inflammation and suppuration.

TREATMENT.—Slight cases of contusion require no treatment. After a few minutes the pain generally decreases, then ceases, and the ecchymosis that shows through the nail is generally eliminated through the growth of the nail.

In severe cases the finger or toe should be immersed in a saturated solution of borax, then dressed with iodoform—or, preferably, with orthoform—if pain continues. The dressing should be changed every day where a toe is the seat of injury. If the nail is partly torn off, it should be carefully cleansed along with the underlying tissue, replaced, and held in place with a bandage applied over the dressing.

Onychia.

This is an inflammatory disorder of the nail popularly called a “run-around,” which may follow an injury such as that

first described or the introduction between the nail and the underlying tissues of infectious matter, along with a foreign body: a thorn, a splinter, etc. The fingertip becomes warm and congested, and severe pain generally accompanies the local inflammatory process. An abscess is formed after a few days, the pus being evacuated through the aperture formed by the offending body. If none such exists, the nail may become softened and perforated. When the accumulation of pus is marked, there may be febrile and other symptoms denoting general involvement.

In the vast majority of cases, however, the symptoms generally become less marked and involution soon follows, sometimes after the loss of the nail. This is always replaced, though not always by as perfect a nail as the one shed.

TREATMENT.—The old treatment by poultices is now supplanted by antiseptic methods that tend to destroy the infectious germs instead of affording them suitable conditions for development. Hot-water baths—as hot as can be borne—sometimes speedily arrest the process. Alcohol acts in the same manner. If a splinter or other infectious body have penetrated the tissues, the pus-cavity can usually be penetrated without pain with an hypodermic needle and washed out with a 1 to 5000 bichloride solution. Bathing the finger in such a solution at frequent intervals, or, better still, leaving it therein an hour several times a day, sometimes arrests the infectious process early in its career. Whenever there is an accumulation of pus imprisoned, however, it had better be liberated by an incision and washed out with the hypodermic syringe. Peroxide of hydrogen 1 part in 3 is very effective in such cases.

Incision into the flesh is always radically wrong, even though the pus may be nearly a drachm in amount. The writer advises separating the attachment of the cuticle to the dorsal or exposed surface of the nail to a sufficient extent to permit the escape of the pus and the introduction of a stick of silver nitrate to disinfect the sulcus. In this treatment there is no disfiguration, Sinclair Tousey (Medical News, Apr. 13, 1903).

Malignant Onychia.

This is a complication of the disorder just outlined, which may occur in persons who are constitutionally weak or adynamic or in so-called "scrofulous" or lymphatic children. It usually affects the index finger, the thumb, or the big toe, and is the active manifestation of a local ulcerative process in the matrix of the nail. The latter becomes brownish or black, and is shed, leaving underneath a granular fungous mass which shows no tendency to heal. The finger sometimes becomes enormously enlarged and discharges considerable foetid pus. Necrosis of the bone of the phalanx involved occasionally follows.

TREATMENT.—Proper active measures usually prove promptly effective. The nail should be removed with forceps. Pain may be prevented by first injecting a 4-per-cent. solution of cocaine under the nail. The parts are then dressed with iodoform. A day or two later, after brushing the parts with a 4-per-cent. solution of cocaine, the ulcerating area is touched with nitrate of silver or with the tincture of the chloride of iron. This should be repeated, if need be, several times at two or three days' interval. If this prove insufficient, acid nitrate of mercury must be used after anæsthetizing the parts with a 10-per-cent. solution of cocaine. Such an application may also be rendered painless, according to Randolph, by saturating the nitric acid with the hydrochlorate of cocaine.

Hypertrophy.

Hypertrophy of the nails is usually ascribed to pressure. It may affect the hands, but is met with, in the majority of cases, in the nails of the feet. The thickening may affect any part of the nail regularly or irregularly, a broad raised mass being sometimes the only evidence of the abnormal process. In the majority of cases, however, the hypertrophy is irregular, the epithelial growth being restricted to areas. The nail, under these circumstances, becomes covered or bosselated and simultaneously yellowish gray, opaque, and very brittle. Though the growth is very gradual, pressure upon the underlying tissues causes local disorders, especially if the nail cracks, when painful inflammatory symptoms follow. It produces heat and discomfort when affecting the feet, shoes being worn with difficulty. When the nails of the hands are the seat of the hypertrophy it constitutes quite a deformity.

TREATMENT.—The overgrowth should be filed down or sawed. In other words, measures tending to give the nail its normal shape should be resorted to. All complications are of the nature of those attending the so-called "ingrowing toe-nail" and the treatment given for the latter condition is also applicable.

Ingrowing Toe-nail.

The term "ingrowing toe-nail" is applied to a condition usually confined to the great toe, in which the edge of the nail (almost always the outer edge) is forced into the adjoining soft parts. Swelling of the latter being induced, they overlap the nail, the point of contact becoming the seat of ulceration and granulations. It is usually due to the pressure of tight shoes, and is therefore generally met with in young adults. It is also frequently encountered in soldiers

as the result of prolonged marching with heavy accoutrements that increase the pressure upon the feet. Lymphatic subjects are more liable to it than others, and the affection is exceedingly persistent in them. It often accompanies diabetes and may occur as a complication of febrile diseases of long duration, fractures and other processes tending to debilitate the organism, hyperidrosis, etc., but most frequently as a result of badly-shaped shoes.

Ingrowing toe-nails in an infant 1 week old. By the end of the third week the condition became such that operation was undertaken. T. W. Parry (*Lancet*, Oct. 14, '99).

TREATMENT.—In mild cases properly fitting shoes giving freedom to the toes, frequent ablutions, and finely-powdered borax or tannin applied to the dressed tissues usually suffice for a cure. The mere daily introduction of cotton under the edge of the nail by gradually raising the latter away from the soft parts is sometimes very satisfactory. Scraping the centre of the nail until it is quite thin occasionally suffices to relieve the pressure.

In the great majority of cases the ulceration requires active measures besides a change of foot-wear. The ulcerated tissues must first be relieved of their granulations. This can easily be done by using the tincture of the chloride of iron after anæsthetizing the parts with a 4-per-cent. solution of cocaine. Or they may be scraped with a curette or gently cauterized with the mitigated stick: oxide of zinc and nitrate of silver. This being done, a small piece of cotton-wool covered with iodoform, iodol, or aristol is gently inserted with a probe into the diseased cavity, the soft parts being raised from the nail. These measures do not always procure a radical cure, however, particularly if the patients again use

narrow or short-tipped shoes. In each case surgical measures are preferable. The simplest of these is to anæsthetize the tissues—or the patient—and, after careful cleansing of the parts, to simply pare off the redundant tissues, granulations and all, on a level with the edge of the nail. The nail-edge being then carefully trimmed, an iodoform dressing is applied. Or the dressed parts may be dissected out and a plastic union obtained by a few stitches.

Simple treatment recommended for ingrown toe-nail. A 40-per-cent. solution of liquor potassa is applied warm to the portion of the nail to be removed. After a few seconds the uppermost layer of the nail will be so soft that it can be scraped off with a piece of sharp-edged glass; the next layer is then moistened with the same solution and scraped off; this must be repeated until the remaining portion is as a thin sheet of paper, when it is seized with a pincette and lifted from the underlying soft parts and severed. The operation does not require more than half an hour's time, and is painless and bloodless. Puerckhauer (*Pittsburgh Med. Rev.*, Feb., '91).

In ingrowing toe-nails plaster applied diagonally around the toe in such a manner that the soft parts shall be drawn away from the nail without direct pressure over the latter is sometimes efficient. A semilunar-shaped piece of plaster is better than a straight strip. It should be applied with the convexity forward, one horn beginning just behind the nail on the affected side. This will allow the belly to catch the offending soft parts, while the remainder of the piece is carried around the planar surface of the toe and over the dorsum, crossing the first end. This dressing should be changed every three or four days. J. L. Andrews (*N. Y. Med. Jour.*, Mar. 20, '97).

An ingrowing nail is easily cured by the following method: All pressure from the nail is removed by cutting away a piece of the shoe and the lesion is disinfected with hydrogen dioxide until no more "foam" appears. A drop of strong

solution of cocaine is then introduced into the base of the ulcer, and a drop of Monsell's solution is applied to the latter. The part is then loosely covered with gauze and the process repeated every second day until the edge of the nail is released by retraction of the hypertrophied tissue. The cure is effected within a couple of weeks without interfering with the patient's vocation. Kinsman (Columbus Med. Jour., Apr. 4, '99).

The older surgeons used to recommend evulsion of the nail: an operation performed by forcibly inserting a scissors under it; but this measure is now condemned because the new nail is generally a malformed one and hypertrophy (*vide supra*) occasionally follows.

In ingrown toe-nail the following method, modified from that advised by Masters, of England, recommended: A flat strip of silver— $\frac{1}{100}$ inch thick, $\frac{1}{8}$ inch wide and 1 inch long—is bent into the shape of a fish-hook. The toe having been cleansed with peroxide of hydrogen and moistened with a solution of cocaine, the hook is inserted under the lateral edge of the nail so that the shank of hook curves over the side of toe and lies close to it. The greater the ulceration, the less the pain in inserting the hook. It is retained in place by adhesive plaster or a bandage. The hook not only protects the flesh from the nail, but it exerts a lifting action on the nail. After a few hours the patient suffers no inconvenience from the hook, and in a few days the swelling subsides and the granulations become more healthy. It is well to wear the hook for several weeks after the tissues have healed. Henry Ling Taylor (Inter. Jour. of Surg., Sept., '96).

All cases of ingrowing nail may be cured without recourse to the knife by proceeding as follows: With a flat probe, or a match, a bit of cotton is slipped between the edge of the nail and the inflamed flesh. Another strip of cotton is put along the outer margin of the ulcerated area, and the space between these two strips of cotton, and which is occupied by the ulcer, is thickly powdered with nitrate of lead.

The whole is covered with cotton, and the toe is bandaged. The dressings are repeated daily until the incarcerated edge of the nail is plainly visible. Usually four or five dressings suffice. Then the edge of the nail is lifted away from the flesh and a bit of cotton is introduced under it. As it grows it will gradually take its proper position above the flesh.

The lead is to be discontinued as soon as it appears that the exuberance of the fleshy bed of the nail has been overcome. The difficulty seldom recurs. If this does happen it is necessary to repeat the treatment from the beginning. Tardif (Anjou Méd., Feb. 1, '98).

Case in which after all usual methods had failed a triangular notch was made midway in the free edge of nail extending to its body. From the pointed margin of this notch a furrow was made, as near to the quick as possible, without penetrating it, through the middle of the root as far as the duplicature of skin; a piece of cork was then inserted under the nail, whose bulk was large enough to extend a few lines on either side of the notch, as well as to compactly fill, without uneasiness, the interspace between the skin and extremity. J. G. MacCullum (Mass. Med. Jour., Jan., '99).

NAPHTHALIN, NAPHTHOL, AND ALLIED COMPOUNDS. — Naphthalin, naphthalene, or tar-camphor, is an hydrocarbon obtained from coal-tar. It occurs in white scales, having a fatty lustre, a strong, coal-tar odor, and a burning, aromatic taste. It is soluble in alcohol and ether, the fixed and volatile oils, and in acetic acid, but it is insoluble in water. It melts at 175° F. It should not give any reaction on moistened blue litmus-paper, and should dissolve in concentrated sulphuric acid, when warmed gently, without color.

Dose.—Naphthalin may be given in doses of 2 to 15 grains in powder or in capsule. The maximum daily dose is 90 grains.

Physiological Action.—Naphthalin is toxic to the lower forms of life, insects, their ova, etc., and is therefore extensively used to preserve clothing from the destructive action of moths, etc. In the human being it temporarily irritates the mucous membrane, but this effect becomes more active when naphthalin is dissolved in oil or alcohol. Internally administered, the urine becomes darkened, showing an irritant action upon the kidneys; an eruption simulating that of measles, and followed by desquamation, has been observed after its use. In animals cataract has followed a continued administration of the drug.

Wishing to prescribe naphthalin for a weak, anæmic woman, suffering from chronic enteritis, effect of the drug was first tried personally, 8 grains in water being taken. Very soon the writer was seized with severe colicky pains in the abdomen, followed almost immediately by diarrhœa, tenesmus, and strangury. The motions, which were very numerous and small, were at first fæcal, but finally contained a great deal of mucus. Four hours after taking the drug vomiting set in, and continued for about fourteen hours. He could retain absolutely nothing. Toward the end the vomited matter was slightly streaked with blood. About fifteen hours after taking the drug the pain became most agonizing. "It seemed as if a red-hot iron were plunged into the kidneys with every heart-beat." This severe pain lasted for about twenty minutes. During this paroxysm the pulse was very slow, and almost imperceptible at the wrist. The urine which was passed soon after was reddish brown, and contained about 25 per cent. (by volume) of albumin. It also contained a few blood-clots, many granular casts, urates, and mucus.

He continued very ill for five days. Temperature was all the time somewhat subnormal; the pulse was at first 45 per minute, but gradually, toward convalescence, rose to 68 per minute. Relief from pains was obtained by hypo-

dermics of morphine and by leeches over kidneys.

Prominent chemist in England analyzed a portion of the drug and he reported the sample to be above the average degree of purity. Otte (Med. Record, Apr. 30, '98).

Therapeutics.—The therapeutic action of naphthalin depends upon its antiseptic and antiparasitic properties.

INTESTINAL DISORDERS.—Naphthalin, in 5-grain doses, has been used with apparent benefit in typhoid fever (Wolff), in acute and chronic intestinal catarrh, in fermentative diarrhœa, and in cholera. It diminishes the activity of the intestinal bacteria, as shown by C. Sehrwald, who advises its use in conjunction with calomel. In dysentery 10 or 15 grains may be given in a warm decoction of althæa (marshmallow) by rectal injection.

In the summer diarrhœa of children, $\frac{1}{6}$ to $\frac{1}{4}$ grain may be given every two to four hours.

ANTHELMINTIC.—Naphthalin in doses of 3 to 10 grains, combined with castor-oil and disguised with a couple of drops of oil of bergamot, is useful in treating ascarides (Mirowitch). Seat-worms are best treated by the injection of 10 or 15 grains of naphthalin in 2 or 3 ounces of oil into the rectum. For tape-worm, 15 grains should be given before eating, followed some hours later by a full dose of castor-oil.

In treatment of tape-worm, a single dose of naphthalin usually suffices. After three meals containing excess of salty and vegetable acid food about 20 grains of the drug are administered in capsule; this is followed in four hours by a free dose of calomel with soda, and this in turn by castor-oil. Hard (Cincinnati Med., p. 711, '94).

Naphthalin is an excellent remedy against *Oxyuris vermicularis*. Dose varies from $2\frac{1}{4}$ grains for a child $1\frac{1}{2}$,

years old to 6 grains for one of 12 or 13 years. It is best given in powder mixed with sugar or in capsule. A good purge is first given, then 4 doses of the naphthalin are given daily for 2 days, repeated 8 days after the first dose, and again repeated after an interval of 14 days. Schmitz (*Jahr. f. Kinderh.*, B. 39, S. 121).

URINARY DISORDERS.—Naphthalin is recommended for glycosuria. It is claimed that it diminishes the amount of sugar, even when the patient is using a mixed diet.

Pyelitis and cystitis are benefited through the use of naphthalin. The drug lessens urinary fermentation. Caution should be observed in administering the drug when the glandular tissue of the kidney is diseased. Magnus has observed a dangerous action of the drug upon the renal tissues, accompanied by a darkened color of the urine, while Panas, Dorr, Hess, and Kolinski claim that in large doses it destroys the red blood-corpuscles.

RESPIRATORY DISORDERS.—Chavernac advises the use of naphthalin by vaporization in pertussis. Rossbach commends its use as an expectorant in chronic bronchitis, given in pills, powders, or troches, and for irrigation of the nasal cavities.

Inhalations of naphthalin in fifteen cases of pertussis in children from 4 months to 11 years of age. From $3\frac{3}{4}$ to 5 drachms of naphthalin were used for inhalations, which were repeated four or five times daily. It may be vaporized in any vessel, care being taken to prevent its catching fire. Of the 15 cases 6 took but one inhalation; 5 received no benefit from the treatment; in the 4 remaining cases the attacks ceased after the third day, expectoration becoming easy and only a simple cough remaining. These 4 cases were recent, 1 of them being only of one week's duration and the other 3 of two weeks'. There were no disagreeable effects from the drug. N. Koroleff (*Med. Obozrenije*, No. 21, '93).

CUTANEOUS DISORDERS.—Scabies is cured by a 10- to 12-per-cent. solution of naphthalin in olive-oil or linseed-oil (Fürbringer). In ointment (5 to 10 per cent.) it is useful in chronic eczema, psoriasis, lepra vulgaris, etc.

As a dusting-powder (with $2\frac{1}{2}$ per cent. of bergamot-oil to cover odor), as spray, or on gauze it is useful in the treatment of abscesses, ulcers, and suppurating wounds. It is also a good dressing for recent wounds. Dusted into the shoe or stocking, it has been found useful in hyperidrosis of the feet.

In treatment of insect-bites, rubbing the parts every few hours with 2 or 3 drops of saturated solution of naphthalin in liquid vaselin recommended. V. Pedkow (*Med. Obozrenije*, No. 24, '93).

Naphthalin employed in a variety of cutaneous and venereal diseases. It does not stain linen. Mixed with olive-oil and gum arabic it forms an emulsion with water, and is completely soluble in chloroform and ether, and slightly so in oil. 1. In all forms of eczema, except in the most acute stages, naphthalin is an excellent application. It is especially useful in chronic and traumatic eczema. 2. In psoriasis improvement always observed. 3. It has a reducing action of nearly the same intensity as ichthyol and sulphur, and may be tried in all cases where these are applicable. 4. It is a useless application in soft and hard chancres and in gonorrhœa. 5. Rectal suppositories containing from 5 to 10 per cent. of naphthalin seems to have a favorable influence on catarrhal prostatitis. Rohleder (*Monats. f. prakt. Derm.*, B. 27, '98).

Naphthalin possesses very great therapeutic powers in promoting the healing of extensive sores and ulcers of the skin, especially chronic ulcer of the leg.

The beneficial effects are usually marked after the first week of treatment, being manifested by the diminution of the discharge, the change in aspect of the ulcer, and by new granulations.

Following method of application recommended: A piece of cotton-wool cor-

responding to the size of the ulcer is first dipped for a few minutes in an antiseptic lotion, then covered with naphthalin and applied to the sore parts; over this a piece of gutta-percha tissue is placed and the whole secured by a bandage, care being taken that the parts previous to application have been carefully cleansed. At first the bandage is changed after eight or ten days; later it may be left for a longer period. H. J. Takowlew (Vratch, Feb. 4, '99).

Naphthol.

Naphthol (naphtol, U. S. P.), isonaphthol, or betanaphthol, is a phenol occurring in coal-tar, but usually prepared artificially from naphthalin (naphthalene). During the process of manufacture two naphthols are formed, the official naphthol being the first to crystallize and being readily separated from the alphanaphthol by boiling alcohol, the latter being insoluble in it. Alphanaphthol is considered to be one and a half times as strong as regards its antiseptic and germicidal powers, but it is not often used internally.

The physiological action, dose, and therapeutic uses of naphthol are practically the same as those of naphthalin. Betanaphthol enters into combination with a variety of bases and acids, the resultant compounds having an added antiseptic action.

Use of betanaphthol recommended as a vaginal antiseptic. Following solution may be used:—

Rx Betanaphthol, 4 drachms.
Alcoholis, 30 drachms.

A teaspoonful is added to a quart of water, which has been previously boiled and filtered, and used as a vaginal injection, either hot or cold, as the case may require. Sunar (L'Union Méd., Feb. 29, '92).

Alphanaphthol and betanaphthol have about the same power of restraining the growth or destroying the vitality of the comma vibrio. In the proportion of 1 in 16,000 they restrain the growth; in

that of 1 in 3000 they kill in 2 hours; in that of 1 in 2000 in 5 to 30 minutes. Resort to these drugs recommended as preventives, and in the treatment of the early stage, of cholera. From Sternberg's *data* it is calculated that entire small intestine is proof against the introduction of the vibrio, and that under similar conditions 40 grains would be germicidal. The maximum daily dose of either naphthol is commonly placed at 1 drachm, but much larger quantities may be given, as the toxic dose for a person weighing 143 pounds is said to be 8¾ ounces. Betanaphthol is to be preferred as a prophylactic, and 5 to 10 grains, finely pulverized and mixed with white sugar, may be taken three to four times daily. In early choleraic diarrhoea similar or larger doses recommended at shorter intervals. D. D. Stewart (Amer. Jour. Med. Sci., Apr., '93).

Betanaphthol employed in 131 cases of enteric fever, with 14 deaths. Kirshberg (Gaz. des Hôp., Sept. 11, '94).

Conclusions in regard to use of betanaphthol in the treatment of cutaneous diseases: 1. Betanaphthol proved decidedly useful in scabies. 2. Betanaphthol cured tinea circinata in a short time, but did not give as good results in other forms of ringworm. 3. Betanaphthol was a good antipyretic. 4. Betanaphthol has very decided stimulating qualities. 5. Betanaphthol proved of more service in chronic inflammations of the skin. J. Abbott Cantrell (Amer. Ther., Mar. 14, '96).

For intestinal antiseptic alphanaphthol is superior to betanaphthol. It has three times the antiseptic power of the latter, and exhibits only one-third its toxic properties. Maximowitsch (Med. News, Jan. 15, '98).

Asaprol, or abrastol, is the sulphuric ether of betanaphthol. It occurs as a white powder, freely soluble in water and alcohol. It has antiseptic, analgesic, and antipyretic properties, and is valuable in acute inflammatory rheumatism, in doses of 5 to 15 grains several times daily.

Benzonaphthol, or benzoyl-naphthol, a combination of benzoic acid and beta-

naphthol, occurs as a whitish powder which darkens with age. It is soluble in alcohol, but not in water. It is antiseptic and diuretic in doses of 4 to 8 grains. With equal doses (2 grains) of bismuth salicylate and $\frac{1}{2}$ grain of Dover's powder it has been recommended by S. Solis-Cohen in cases of infantile diarrhœa.

Iodonaphthol, or di-iodide of betanaphthol, is a combination of iodine and betanaphthol. It occurs as a greenish-yellow, tasteless and odorless powder, soluble in chloroform; slightly soluble in alcohol, ether, and acetic acid; and insoluble in water. It has been used chiefly as an antiseptic dusting-powder on wounds and ulcers.

Lactonaphthol, or lactol, a combination of lactic acid and betanaphthol, is used chiefly as an intestinal antiseptic. Fifteen grains may be given daily in divided doses.

Microcidin, or sodium naphtholate, a combination of caustic soda and betanaphthol, occurs as a yellowish-gray or white powder, soluble in 3 parts of water. It is used in solution (3 to 5 parts per 1000) as an antiseptic and germicide in diseases of the ear, nose, and throat and as a surgical antiseptic for bandages, etc., in 3- to 5-per-cent. solution.

Microcidin is one of the most useful antiseptics and disinfectants that we possess. Confirmation of Tarnier's view that its action as a germicide is almost as powerful as corrosive sublimate, while it has an advantage over the latter in not attacking metallic instruments, except those made of aluminium. Steel and nickel-plated instruments may be left in solutions of microcidin for twenty-four hours with impunity. McKay (Intercol. Med. Jour., Mar. 20, '99).

Naphthol-aristol, or di-iodo-betanaphthol, occurs as a yellowish-green powder without odor or taste. It is insoluble in water, soluble in chloroform, and slightly

soluble in alcohol and ether. It is used as an antiseptic instead of aristol.

Naphthol-bismuth, or bismuth betanaphtholate, occurs as a light-brown insoluble powder, without odor. It is used internally as an antiseptic in affections of the intestines, like salol, in doses of 15 to 30 grains.

Naphthol-camphor, or camphorated betanaphthol, occurs as a clear, brown, syrupy liquid, soluble in alcohol. It is composed of naphthol, 1 part, and camphor, 2 parts, and is recommended as an application for tuberculous affections, and when mixed with oil for ozæna, coryza, scabies, and furuncles.

If 2 parts of camphor be heated with 1 part of betanaphthol, there results a liquid which will dissolve the fixed and volatile oils, the alkaloids, and iodine. Déséquelle (Provincial Med. Jour., Sept., '89).

Case in which, although 5 cubic centimetres of camphorated naphthol had been injected into the articulation with no bad results only eight days before, only 4 cubic centimetres caused suddenly convulsions, delirium, weak pulse, cyanosis, and pulmonary œdema. The breath, two minutes after the injection, had a strong odor of camphor. The convulsions and delirium ceased in about ten minutes, but cerebral weakness lasted several days. Sinding-Larsen (Norsk Mag. f. Laegevidensk., Sept., 1900).

Salinaphthol, betol, naphthalol, or betanaphthol-salicylate, a combination of betanaphthol and salicylic acid, occurs as a white powder without odor or taste, soluble in boiling alcohol and ether, but insoluble in water and glycerin. It is used as an internal antiseptic, antizymotic, and antirheumatic, in doses of 4 to 8 grains, in wafers, milk, or emulsion, four times daily.

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NASAL CAVITIES, DISEASES OF.**Acute Rhinitis (Acute Coryza).**

Acute rhinitis is divisible into *acute catarrhal rhinitis* and the more unusual forms of *acute purulent* and *croupous rhinitis*.

Acute Catarrhal Rhinitis.

Symptoms.—The onset of a cold is marked by local symptoms and a general reaction, which does not differ in kind from that which accompanies local inflammations in general, embracing lassitude, chilliness, myalgia, and more or less fever. The local symptoms comprise a stage of dryness accompanied by sneezing and followed by a profuse discharge, at first watery and later muco-purulent. Of collateral symptoms there are: nasal voice, impairment of the sense of smell, and especially obstruction of one or both sides of the nose, this latter phenomenon being due to the turgescence of the erectile tissue of the turbinated bodies.

If the nostrils are examined during an attack of acute catarrhal inflammation the entire mucous surface will present a vivid red appearance; the inferior turbinated structures are engorged with blood and in contact with the swelled septum. This congestion is usually not so intense in the posterior part of the nasal passages. The secretions are at first serous, later mucous, and finally become muco-purulent.

Etiology and Pathology.—Acute catarrhal rhinitis, or coryza, may be excited alike by exposure to cold and draughts, by various inhaled substances which may act either chemically or mechanically, by certain ingested substances which are eliminated through the nasal mucosa (iodine), and finally by specific bacterial poisons in the course of general infectious processes, such as measles, scarlet fever, influenza, etc. With the exception of this latter subdivision there is no

class of cases of catarrhal rhinitis in which the likelihood of bacteriological causation can be demonstrated.

The coryza which accompanies specific fevers is undoubtedly in some cases purulent, however, and due to the usual exciters of suppuration.

With regard to the part played by various fumes, forms of dust, and the like, the subject encroaches upon the domain of hay fever, which is separately considered in this work.

A predisposition to cold in the head is furnished by a variety of local conditions, such as deformity of the septum, adenoids and other chronic affections of the nasal and pharyngeal passages, and perhaps by certain general dyscrasic conditions, such as syphilis and tubercle. Children are more commonly affected than adults; and women than men.

Catarrhal rhinitis is naturally prone to spread by continuity of tissue, and may or may not extend into the sinuses, naso-pharynx, middle ear, nasal duct, etc., producing added symptoms referable to the organs secondarily implicated.

Treatment.—The treatment is general and local. Much can be accomplished in the first twenty-four hours of a cold by active cathartics, prohibition of alcohol and tobacco, and a plain diet. In addition to this, sedatives—such as salol and phenacetin, $2\frac{1}{2}$ grains each every hour for four doses, or 15 grains of bromide of potassium repeated every two or three hours—are of marked benefit. One of the best ways of shortening the duration of cold in the head is to prohibit the constant desire to blow the nose. Although it is uncomfortable, if the patient will allow the serum to remain in the nose, it prevents by pressure further transudation and allows the glandular structure to become quiet. Saline washes should not be used during

the serous stage of the disease, certainly not before the secretions become thickened.

Powders are of benefit, and I prefer the compound stearate of zinc and boric acid, to which may be added $\frac{1}{2}$ of 1 per cent. of cocaine. This may be used at least four or five times in the twenty-four hours.

If oily sprays are used they should be exceedingly mild in combination, not adding more than a grain or two to the ounce of such remedies as thymol or eucalyptol. Stronger solutions can only be of benefit by increasing the irritation, exciting the serous transudations and so eventually exhausting the glandular structures.

I have seen acute coryzas checked by a finely localized application of chromic acid or the galvanocautery. Undoubtedly the benefit was produced by reason of counter-irritation, and the general congestion was centered at the one point where the cautery was applied.

Spray of benzoate of soda highly extolled during first stage and continued at frequent intervals during twenty-four hours. Anfruns (*Revista de Lar., Otol., y Rinol.*, vol. ix, No. 8, '94).

Following procedure sometimes gives rise to excellent results in acute rhinitis: At the outset of the coryza the nasal cavities are to be sprayed with a small quantity of a mixture of 1 part of ichthyol and 100 parts each of ether and alcohol. This application of the spray is to be made only once. Unna (*Pacific Med. Jour.*, Feb., '95).

If effervescent citrate of lithia, 10 grains, are taken in a tumblerful of water, when the first symptoms of acute rhinitis appear, the full development of the disease is prevented. In some cases the dose of lithia may be repeated several times. Bishop (*Laryngoscope*, Dec., '97).

Statement of Bulkley corroborated, that from 60 to 100 grains of sodium bicarbonate taken in twenty-four hours

in the early stage of rhinitis, especially in subjects of the uric-acid diathesis, will completely abort the attack. Careful dieting and abundance of out-door exercise are factors that should enter into the treatment of the inflammatory diseases of the upper air-passages. J. C. Mulhall (*N. Y. Med. Jour.*, Nov. 12, '98).

Coryza can be aborted by using locally a solution of belladonna tincture (B. P. 1899) in water. The strength used is 1 or $1\frac{1}{2}$ drachms in 1 ounce of water. The nose having been well cleared out, a dessertspoonful of the solution applied to one nostril, the other nostril and the mouth are closed, and, while gradually raising the distal end of the irrigator, a long inspiration is made until the air, in bubbling through the solution, carries with it a coarsish spray. Afterward the other nostril should be sprayed in the same way, and then, having well cleared out both nostrils, the process is to be repeated. W. E. Burton (*Brit. Med. Jour.*, June 10, '99).

The following formula is recommended:

R. Heroin, 1 grain.
Atropine sulphate, $\frac{1}{25}$ grain.
Caffeine citrate, 15 grains.
Salophen, 75 grains.

This is to be divided into fifteen capsules, one of which is ordered four times daily. Wetherby (*Med. Council*, Nov., '99).

An aqueous solution, 20 grains of dried suprarenal extract in $\frac{1}{2}$ ounce of water filtered through cotton, to the congested nasal mucous membrane in coryza (after clearing the nose and naso-pharynx with an alkaline wash of sodium salicylate, sodium bicarbonate, and boric acid), applied on pledgets of cotton, can take the place of cocaine in the relief of congested mucous membranes. Millener (*Buffalo Med. Jour.*, lv, p. 585, 1900).

Untoward effects of local applications. Secondary hæmorrhage following the intranasal use of suprarenal extract observed in three cases in which it had been used during operations. Numerous instances in the hands of other laryngologists. It was occasionally observed that in some patients there was an idiosyncrasy against its use, violent coryzas

following its application to the nasal mucous membrane. Spasmodic and prolonged sneezing observed in two cases. It would thus seem that the powerful stimulation to contraction of the swollen mucous membrane, induced by the suprarenal extract, while equal to retaining a grip on the dilated blood-vessels for a long time, does not yet suffice to prevent indefinitely, but only to delay, the paralytic stage following the use of cocaine. It also seems to be true that the final relaxation attending the combined use of the two agents is greater than that following cocaine alone. The nasal fossa should be carefully packed after every operation. F. E. Hopkins (N. Y. Med. Jour., Aug. 25, 1900).

Acute coryza may sometimes be aborted in an early stage by the frequent inspiration of the vapor of "Brand's remedy," which consists of *acidi carboli puri*, *ammonii liquoris*, of each, 5; *alcoholis* (90 degrees), 10; *aquæ destillata*, 15 parts; or by a single intranasal spraying with *ichthyol*, 5; *alcohol*, *ether*, of each, 50 parts by weight. The most rational abortive treatment is, however, to paint the Schneiderian membrane with a vasoconstrictor, such as cocaine, or still better,—because its action is more prolonged and equally intense,—with an aqueous extract of suprarenal capsule. Vacher, of Orleans, has by this treatment frequently suppressed a cold within a few hours. The hyperæmia of the mucous membrane soon disappears, and with it the symptoms of coryza. The crystalline hydrochloride of adrenalin, isolated by Takamine, is equally efficacious. The commercial solution is of a strength of 1 in 1000, but solutions of 1 in 5000 or 1 in 6000 are sufficiently powerful. Perhaps the surest way to abort a cold is to paint the mucous membrane two or three times with suprarenal extract or a solution of adrenalin, and to inhale Brand's remedy frequently in the intervals. When a cold has once developed much may be done to relieve the headache and the sensation of nasal obstruction. The symptoms improve at once if the mucous membrane is sprayed every two or three hours with a tepid, 1-per-

cent., watery solution of cocaine, or, still better, with hydrochloride of cocaine and menthol, of each, 5 parts, dissolved in 100 parts of liquid paraffin. Even in cases of chronic coryza painting the mucosa with adrenalin or suprarenal extract greatly assists the restoration of nasal permeability. Spiers believes that the abundant nasal discharge is largely kept up by reflex irritation. He therefore treats coryza by post-nasal insufflations of orthoform, and claims to have had good results. Early treatment of coryza is both curative and prophylactic, and may frequently prevent extension of the process to the sinuses or middle ears. Pugnât (Brit. Med. Jour.; from Rev. Méd. de la Suisse Rom., May 20, 1902).

Where repeated coryzas are simply an indication of a chronic pathological condition of the nose, such as deformities of the nasal septum, or adenoids, or polypi, these should be promptly removed in order to prevent acute attacks.

Simple Acute Coryza of Infants.—Obstruction of the nose in the adult is only a source of inconvenience; but in the nursing infant it becomes a serious disorder, interfering with nursing and interrupting sleep by causing dyspnœa.

Suffocative attacks which may present themselves at the moment of going to sleep in infants with acute rhinitis may be confounded with croup, the symptoms being cyanosis of the face, movements of the *alæ nasi*, nasal râles, violent action of respiratory muscles, leading sometimes to complete temporary arrest of respiration, and ending, perhaps, in convulsions. While sucking, the respiratory need may become suddenly so great that the infant throws back its head and makes an inspiratory movement, which may lead to milk being drawn into the larynx. Tissier (Revue Men. des Mal. de l'Enfance, Jan., '94).

A few drops of paregoric administered several times during the day will have a quieting effect on the congested mucous

membrane. Simple steam-inhalers can be procured at very little cost, and such medicaments as oil of tar, paregoric, and compound tincture of benzoin can be used. A few drops of plain liquid alcoholene may be placed in the nasal passages with a dropper, or a powder composed of equal parts of compound stearate of zinc and boric acid and subnitrate of bismuth can be used.

For infantile coryza and for children who suffer much from coryza, a spray of borate of soda, $\frac{1}{2}$ drachm, and infusion of coca, 8 ounces, recommended. The fluid can either be used with the atomizer or thrown into the nostrils with a dropper. This solution is capable of reducing the tendency to relapse and is safer than cocaine. W. Cheatham (Collaborator, Annual, '89).

In acute rhinitis of infants hydrate of terpene, $\frac{7}{8}$ to $1\frac{3}{4}$ grains, according to whether the infant is below or over 1 year of age, recommended. The remedy is to be administered three times a day. Lewy (Archiv f. Kinderh., B. 17, H. 5, 6, '94).

Croupous Rhinitis.—This variety occurs under various circumstances. Aside from nasal diphtheria, which is best considered under the general heading of diphtheria, we occasionally see in what seems to be an ordinary rhinitis the formation of false membranes; and within the latter have at times been found Klebs-Loeffler bacilli, apparently in a non-virulent condition. Other cases of pseudomembranous rhinitis follow the application of the galvanocautery to the nasal mucosa.

About 77 cases of membranous rhinitis collected. In 41 there is a clear record of a bacteriological examination, and in 33 the Klebs-Loeffler bacillus was found, while in 1 the result was doubtful. In several other cases the membranes were examined, and found not to differ from those of diphtheria. In all of the cases the disease ran a benign course, and in all but a few the membrane was limited exclusively to the nose, and the con-

stitutional symptoms were not marked or were entirely absent.

In the great majority of cases, if not in all, the bacteriological diagnosis is the only safe one, and all cases should be considered as diphtheria until the contrary has been proved by cultural methods. In the meantime isolation and disinfection should be insisted upon. M. P. Ravenel (Med. News, May 25, '95).

Twenty-three cases of fibrino-rhinitis, of which eight, or a little more than one-third, revealed no diphtheria bacilli. D. B. Kyle (N. Y. Med. Jour., July 6, '95).

One hundred and twenty cases of croupous rhinitis or membranous rhinitis reported in various papers collected. In fifty of them there appears to have been a bacteriological examination, and in sixty-five a positive result as far as Klebs-Loeffler's bacillus. J. T. Campbell (Ann. Otol., Rhin., and Lar., Aug., '97).

It is a rare affection, and the rhinologist has but few opportunities to study it.

It has been thought that the gouty, rheumatic condition is a factor in producing it. Differential diagnosis will always have to be made between it and nasal diphtheria. In addition to microscopical aid perhaps these differential points are the most marked: Nasal diphtheria occurs in children, croupous rhinitis usually in adults. The exudate in nasal diphtheria is more yellow in color, is soft, friable, coming away in small pieces, whereas the cast found in croupous rhinitis may be removed entire, and is whiter and firmer. A bleeding surface will be found beneath the diphtheritic membrane, but not in the patient suffering from croupous rhinitis. In two out of five cases of croupous rhinitis which I have seen the patients had no constitutional disturbance and were about all the time. The disease does not last more than four or five days. During the first two there is a strong tendency to reformation of the membrane when it is removed. As has

been said, the membrane very much resembles that which sometimes follows the use of the galvanocautery, or which appears over the point of the puncture made through the anterior pillar of the pharynx during an attack of peritonsillitis.

Treatment.—The course of this disease is limited to a few days. Internal sedatives may be administered if there is annoying, acute nasal disturbance. The length of the disease will not be shortened by the removal of the membrane or by overwashing. The removal of loosened secretions by irrigation and the insufflation of a boric-acid powder, to which may be added a few grains of powdered alum, are usually sufficient.

It is wise to isolate the patient and to burn the cloths which receive the nasal discharges.

In croupous rhinitis iron exercises peculiar influence in controlling the fibrinous exudates. Mercurial preparations also exert a decided curative effect upon the disease, especially in children, and preference should be given to the mild chloride, giving a child six years of age 1 grain every four hours, or oftener. The calomel treatment should be thoroughly tested in the early stages of the attack in children, but if no decided amelioration of symptoms are noticed by the end of the second day, then the iron treatment should be substituted. Bulson (Columbus Med. Jour., Oct. 1, '95).

Purulent Rhinitis.—This is known to be due in individual cases to the gonococcus, streptococcus (scarlatina), and the special erysipelas-coccus and probably also to other bacilli. It is purulent from the start, and the symptoms witnessed in an ordinary catarrhal coryza assume a more violent character. This type is extremely rare in adults, and is probably far from unusual in very young children; but definite *data* are lacking upon this point.

The appearance of the nasal passages is similar to that seen in acute coryza, with these differences: whereas in the latter the secretion is a watery serum, in the former it is a thin, yellow pus which has not the adhesive quality so markedly as has the pus which has its origin in the accessory cavities.

A differential diagnosis must be made between this form of rhinitis and the many cases in which there is abundant muco-purulent secretion—sometimes almost entirely purulent because of defective posterior drainage, as in children with adenoids or in adults with polypi. A purulent secretion symptomatic of disease of the accessory sinuses is, as a rule, unilateral, and but little difficulty is experienced in tracing the secretion to the special locality affected. The nature of a unilateral purulent discharge caused by a foreign body, or a specific ulceration, or occurring during one of the eruptive diseases is readily recognized.

Treatment.—A purulent rhinitis due to the gonococcus requires careful disinfection by means of Seiler's solution, to which may be added a 10-per-cent. solution of "boroformalin," or boro-lyptol. After all secretions have been washed away probably nothing better may be used than a powder of subnitrate of bismuth and boric acid.

Chronic Rhinitis.

General Considerations.—This seems the best name for this affection; indeed, we can no longer use as a synonym "hypertrophic rhinitis," hypertrophy being far from always existing. The same causes may produce in one case only increased secretion, in another intumescence, while in a third the entire mucous and submucous structures may become permanently thickened. Chronic rhinitis is a complex entity, made up of several clinical conditions which differ

widely from one another. Leaving for convenience entirely out of consideration atrophic rhinitis, which, while it may exceptionally follow the common form of chronic rhinitis, is probably a different malady, we have first to distinguish theoretically, rather than practically, between chronic catarrhal and chronic purulent rhinitis. The last-named affection is rather a symptom of several widely different affections than a distinct disease. A discharge of pure pus from the nose is seen, for instance, in connection with foreign bodies and rhinoliths, with sinus disease, and with any form of ulceration within the nose (syphilis, glanders, etc.); it also accompanies post-nasal adenoids in children.

[Grünwald, alluding particularly to nasal suppuration, argues that pus is formed whenever the secretions of ordinary inflammation cannot find suitable drainage. As a rule, a true purulent discharge is confined to one side of the nose, because the exciting cause is generally unilateral. A purulent discharge is often foetid, and, according to Grünwald, a very large part of what is termed ozæna is simply foetid suppuration in connection with undrained secretions (when, for any reason, there is an impediment to either the forward or backward exit of intranasal secretions), as in ethmoidal or other sinus disease, foreign bodies, syphilitic or other ulceration, etc. It has been claimed that very young children may suffer from chronic suppurative nasal discharge which has been ascribed to the continuation of a nasal gonorrhœa contracted soon after birth or to early inherited syphilis.

Nasal suppuration, then, is an important subject clinically, but does not represent a distinct pathological process and has little in common with chronic catarrhal rhinitis. CLARENCE C. RICE.]

Chronic catarrhal rhinitis is divisible according to the stage or degree of the process into *simple* and *hypertrophic*, while the progressive tendency of the

disease to lead to the production of tumor-like formations has been characterized as a terminal stage. Of the so-called intranasal neoplasms by far the greater part may be shown to originate in this manner. The papillomatous or mulberry-like growths which are frequently seen upon the posterior end of the lower turbinate body are merely an advanced stage of hypertrophy peculiar to this locality, while the polypi so commonly seen in connection with rhinitis affecting the middle turbinated have a more complex origin, but are generally admitted to be dependent upon pre-existing inflammation either of the mucosa of the affected locality or of one or more of the neighboring sinuses.

There is, however, another element to be considered in connection with chronic rhinitis—one which has greatly complicated the understanding of the disease by the general practitioner. We refer to the phenomenon of *intumescence*, which is due to turgescence of the erectile tissue over the turbinate bodies. This swelling and consequent obstruction, for the time being, of the nasal fossæ, or rather fossa,—for it is almost invariably unilateral, although readily alternating from side to side,—is a feature which may occur in health as a pure reflex from a variety of causes,—such as irritating vapors, the menses, sudden exposure to cold, etc., or in an acute coryza or hay fever. In chronic rhinitis, however, it plays a highly important part; so much so that to many general practitioners this intumescence is mistaken for hypertrophy. Intumescence, however, usually involves the anterior aspect of the turbinates, while real hypertrophy is apt to be posteriorly situated; intumescence is practically a universal phenomenon, while hypertrophy is by no means frequent. The gravity

of error in diagnosis lies in the fact that many practitioners "burn off anterior turbinates" under the impression that they are destroying hypertrophied tissue, and thereby removing a permanent obstacle, instead of cauterizing a comparatively healthy membrane. Some authorities, such as Ingals and MacDonald, and others, probably with a view of preventing this blunder, have divided chronic rhinitis into intumescent and hypertrophic; but, of course, there is nothing to prevent the occurrence of intumescence in a nose the seat of hypertrophy. It would be correct, however, to speak of simple intumescence and intumescence with hypertrophy.

Another complicating feature in discussing the pathology of chronic rhinitis is to determine whether the condition known as *simple chronic rhinitis* should be considered an entity. If by this term is meant simple intumescent rhinitis without hypertrophy, no obscurity could result; but this is not the idea intended to be conveyed by authors who describe an affection in which not even intumescence is present, and when almost the only symptom is increased secretion.

Symptoms.—The gross appearance in the nasal passages differs according to the stage of pathological change which has been reached. In the most usual form, that of intumescence, the mucous membrane appears moist, but the color varies according to the general condition of the patient. In anæmic patients, although great boggiess of tissue is apparent, the color is not heightened above the normal, and very frequently it is less reddened. Intumescent swellings which are pale in color are also an indication of passive congestion due to nasal obstruction situated posteriorly. We notice these pale anterior swellings where polypi are present, or where posterior

hypertrophies are large, and we are apt to see them in children with post-nasal adenoids. But, as a rule, in chronic rhinitis the inferior turbinated tissues are redder than normal. These anterior swellings differ in size from day to day; sometimes one nostril will be almost entirely obstructed and the other free, while at the next examination the larger swelling appears in the opposite nostril.

Where deflection of the septum co-exists, the inferior turbinated must necessarily be smaller in the narrow nostril than in the broader one, and it must not be forgotten that the size of the inferior turbinated body should always bear a proper relation to the size of the nasal passage. In a very spacious nostril the turbinated structure must necessarily be large to sufficiently exclude foreign bodies and to sufficiently saturate and warm the inspired air. Hence it should not be reduced in size even though it appears larger than normal.

With the general intumescence of the inferior turbinated bodies we may also have a degree of congestive swelling and thickening of the soft structures covering the septal partition. The touch of the probe will demonstrate how much of this swelling is congestive and œdematous, and how much is due to real tissue-thickening. The posterior rhinoscopic view will demonstrate swelling at the posterior end of the inferior and middle turbinated bodies, but here the color is paler and we are more apt to find a true hypertrophy of tissue. We do not often note a large amount of secretion in chronic rhinitis of the intumescent variety except during acute coryza, or unless disease of one of the sinuses co-exists.

As a result of this long-continued congestion we find that hypertrophy has taken place at the anterior end of the

lower turbinated and the posterior end is seen to be the seat of papillary swellings. The middle turbinated body is not so apt to be modified by hypertrophic enlargements of this character, but a chronic rhinitis here manifests itself in enlargement of bony tissue, frequently with fungoid granulations on its anterior face, or with that form of oedematous inflammatory growths which are called polypi.

The subjective symptoms depend upon the amount of nasal obstruction and its location. The obstructing tissue may cause only temporary stuffiness of the nostrils, or the occlusion may be so great as to give the patient serious inconvenience during the day, and compel him to breathe through his mouth at night. Distressing symptoms—such as pain through the forehead, eyes, and cheeks—are not apt to be marked unless the accessory sinuses are involved; but we frequently hear patients complain of a feeling of dullness, dizziness, loss of memory, partial loss of sense of smell, errors of vision, closure of Eustachian tubes, impaired hearing; and, if nasal obstruction is not relieved, he presents the symptoms of pharyngeal and laryngeal catarrh later on.

Etiology.—It is, perhaps, safe to say that bacteria play little or no part in the etiology of chronic catarrhal rhinitis. They have not been found beneath the surface, and even upon the surface of the mucosa they occur so sparingly that the nasal mucus is reputed to possess bactericidal powers. In chronic purulent nasal discharge, on the other hand, the ordinary microbic exciters of supuration play a definite rôle.

In a very small proportion of cases certain kinds of dust and vapors continuously inhaled in connection with the occupation or habits are a sufficient

exciting cause of a form of chronic rhinitis.

Pathology.—The habit of constantly taking cold is now generally believed by rhinologists to depend upon anomalies of the septum, such as deviations, spurs, and crests; and in the case of the young to post-nasal adenoids as well. The great improvement which follows the removal of all these obstructing and irritating conditions is a sufficient proof to fix the responsibility of causation in these cases. There is a special dependence of the phenomenon of intumescence upon these deformities which shows that they contribute largely to that turgescence of the mucosa and consequent obstruction of the nose which constitutes a large part of the symptomatology of rhinitis.

[A chronic catarrhal affection in a perfectly formed nose, without septal anomalies and minus the phenomenon of habitual intumescence would represent a simple chronic rhinitis and is admittedly of rare occurrence. Since certain authors, like MacDonald, attach especial significance to the shape of the nose in connection with intumescence, claiming, as they do, that the narrow, or Hebraic, type of nose especially allows obstruction from a slight degree of turgescence, it is evident that we must rate this narrowness of nose as a factor in the same class with septal anomalies. The high-arched palate has also been claimed as a remote factor in the production of chronic rhinitis by narrowing the vertical diameter of the nasal fossæ and thus producing distortion of the septum. But it must not be forgotten that the high-arched palate and the secondary deviation of the septum are both usually the result of long existing post-nasal adenoids, which also produce chronic rhinitis by preventing post-nasal drainage and interfering with the nasal circulation.]

Naturally the implication of the size and shape of the nasal fossæ involves the question of heredity and racial tendencies in the causation of the disease.

Men are affected twice as often as women: a fact which may be explained by the greater frequency of septal anomalies in men. CLARENCE C. RICE.]

The changes induced in long-standing chronic rhinitis are either diffuse or circumscribed, and it is the failure to understand the purport of this distinction which has led to much of the obscurity in which the pathology of chronic rhinitis is involved. In the natural course of events any prolonged inflammation of a mucous membrane must necessarily be attended with a certain amount of thickening and induration, with atrophy of some of the glandular elements. But there is nothing to show that this last process even attains a high degree in the nose, and to confound it with atrophic rhinitis is, for many reasons, unjustifiable.

In conclusion, then, the mucosa of the nasal fossæ as a whole undergoes the changes which occur in chronic inflammations of other mucosæ, but they are not of high degree and are completely overshadowed by certain circumscribed changes known as "hypertrophies," the presence of which gives rise to the clinical variety known as "hypertrophic rhinitis."

HYPERTROPHIC RHINITIS is a phenomenon believed to depend wholly upon intumescence, which occurs only in certain areas provided with erectile tissue.

The constant determination of blood to the erectile tissues of the turbinate bodies has the tendency to cause hypertrophic thickening of the mucosa in those localities. Several points, however, remain obscure. In some individuals intumescence of years' duration does not produce hypertrophy, while in other cases the latter change sets in rapidly. Still more difficult to understand is the much greater tendency of

the posterior end of the lower turbinate to undergo hypertrophy, although the remaining surface of the turbinate bodies is equally inclined to turgescence.

The general practitioner always, and we believe, justly, lays stress upon cardiac, pulmonary, hepatic, or renal affections which are competent to disturb peripheral circulation and so produce active or passive nasal congestion as factors causing nasal turgescence. The use of alcoholic stimulants and tobacco are potent factors, as is exposure incident to the irritation of many peculiar occupations. But far more important than these is the fact that in the great majority of cases nasal intumescence and hypertrophy are caused by the same pre-existing nasal conditions which have been mentioned as the cause of acute rhinitis.

Treatment.—The treatment of chronic rhinitis is to-day largely operative, but I must be careful to explain that I use this term even in describing such moderate forms of treatment as the application of chromic acid or the galvanocautery to hypertrophied tissues. The primary indications in the treatment of chronic rhinitis are to remove obstructions so that nasal breathing, circulation, and drainage will no longer be interfered with. If crests and spurs on the septum are present and by their irritation produce intumescent swellings, what is more reasonable than that they should be removed?

No single instrument answers for the removal of all forms of enlargement or for correction of deviation of the nasal partition. It is always well to remember that as little of the mucous surface as possible should be destroyed. The saw is particularly applicable for the removal of enlargements of the cartilaginous septum, and, as a rule, there is sufficient

thickness to enable the operator to remove enough of the obstructing septum without producing perforation.

It is often difficult to commence the incision with a saw, but this can be facilitated by turning the patient's head toward the nostril which is to be operated upon, thus causing the convexity of the septum to become as prominent as possible. In commencing the saw can be directed almost at right angles to the partition. After the incision has been carried down to the bony sutural line the remainder of the separation may be effected with sharp-cutting nasal scissors and the piece removed with nasal forceps. It is wise to protect a nasal ulceration made by saw and knife with a powder, like boric acid or iodol, rather than to attempt to prevent sepsis by unsatisfactory nasal washings.

If the cutting is properly done compound stearate of zinc and boric acid will almost always prevent symptoms of sepsis. If the patient shows a rise of temperature and suffers it will be necessary to commence post-nasal washings with an antiseptic solution. All danger of sepsis is past in three or four days, and then it is better to discontinue powders and remove accumulated secretions by irrigating with a post-nasal syringe.

If the septum deviates too slightly for the use of the saw, it will be found useful to reduce the thickness somewhat by linear applications of chromic acid or trichloroacetic acid. Instead of fusing crystals on a probe it is more convenient to add a few drops of water to the crystals, thus making a saturated solution. Care should be taken not to daub this solution over the general surface, but rather to carefully localize the application.

I do not advocate the free use of the galvanocautery on the septum, but in-

stead, a very carefully localized application may be made at a single point to cartilaginous or bony excrescences no larger than a good-sized pea. One puncture in the centre of such a swelling will reduce them sufficiently.

A word should be said in regard to the important part of restoring the nasal mucous membrane to its normal smoothness and moistness after operative work.

Connective tissue is not mucous membrane, but it can be sufficiently polished—so to say—that the surface will not cause secretions to accumulate. Friction ten or twelve times over a granular cicatrix with a disinfectant such as boroformalin or borolyptol causes the surface to become perfectly smooth and moist.

For the reduction of anterior turbinated swellings the snare is at present very infrequently used. In the older days intumescent enlargements were removed by means of the transfixion-needle and cold snare, but this has been proved to be unnecessary. Occasionally inferior-turbinated swellings progress until pediculated papillary hypertrophies are present. The neck-like attachment of such swellings invites the use of the cold snare, but the scissors do the work much more quickly and painlessly, although the bleeding is more profuse.

In the vast majority of cases, however, the condition found at the anterior end of the inferior turbinated is of the intumescent variety, and such erectile swellings may be reduced by applications of chromic acid or by the galvanocautery-puncture. In using the galvanocautery too much caution cannot be used to employ it at a low grade of heat (cherry red) in order not to destroy too greatly the part to be reduced or to scorch the neighboring tissues.

Deformities about the septum should

be corrected before any surgical work is directed toward the turbinated structure, because turbinated enlargements are very frequently only the result of irritation produced by abnormalities of the septum.

In regard to the posterior ends of the turbinated bones, there are very few soft-tissue hypertrophies which cannot be reduced sufficiently by means of chromic acid. It is difficult to apply the snare to the posterior ends of the turbinated bones, and no one but a skilled operator will be successful. Nothing is to be said in favor of the galvanocautery in this region, and there is apt to be troublesome bleeding if we use cutting instruments. When, therefore, inferior- or middle- turbinated hypertrophies are present posteriorly, as shown by the rhinoscopic mirror, a 4-per-cent. solution of cocaine should be applied to the post-nasal pharynx and soft palate, and the self-retained palate-hook used to draw the soft palate well forward so that there is ample space to allow the chromic acid to be placed upon the posterior ends of the turbinals. With the palate forward, the patient himself can depress his tongue with a spatula, while the operator, holding a mirror with his left hand, can with his right reach the posterior hypertrophies. (For enlargements of the middle turbinated body see ETHMOIDITIS under SINUSES, and POLYPI in this article.)

In regard to the *medicinal* treatment of chronic rhinitis there is a tendency among patients who consult rhinologists to overwash the nostrils. I do not mean that the nasal passages should not be kept clean, but that in chronic rhinitis of the moist type it is seldom necessary to use nasal douches continually twice a day for months. Constant washing, and especially with strongly pungent solu-

tions, produces an irritation which tends to prolong hypersecretion. Often have I seen very abundant secretion cease almost entirely as soon as the washing was stopped. Where the nasal discharge is very thin—almost entirely serous—as it is in certain irritable forms of chronic rhinitis, a slightly astringent powder—boric acid, subnitrate of bismuth, with a few grains of powdered alum to the ounce—will often stop the secretion and contract greatly-congested mucous surfaces.

Post-nasal washing by skillful hands is preferable to anterior nasal douching; and next to this the nasal douche-cup, when the patient has been impressed with the importance of keeping the mouth open and not swallowing. The cheap nasal atomizers sold are frequently of no use except to force air into the nostrils.

Post-nasal washing is necessary wherever the secretions are thick,—that is, composed of mucus and pus,—and also in all stages of atrophic rhinitis. A pint of fluid should not be used if two or three ounces are sufficient to clear the nasal passages. Seiler's tablets, to which may be added a drachm to the ounce of boroformalin or borolyptol, are valuable as the basis of a solution for these purposes.

The proper selection of oils and powders depends upon the appearance of the mucous surfaces. Powders should not be employed, since they nearly always tend to dry on a mucous surface which shows a tendency to atrophy; the oily solutions, on the other hand, are effective. Where the mucous membrane is congested and the secretions thin and watery, nothing is more useful than a powder such as 1 drachm each of boric acid and subnitrate of bismuth, 10 grains of phenacetin, and 5 grains of eucaine.

Briefly, the indications in the treatment of chronic rhinitis are, first, to reduce or remove hypertrophies and swellings, and after that to encourage the return of the nasal passages to their normal condition by proper cleansing, and by protecting the mucous surfaces with a carefully-selected oily solution or with powders. I believe that the benefit to be derived from oily solutions is, first, by reason of the protection they give to mucous surfaces, and, second, by the astringent effect secured through the rapid evaporation of such volatile substances as menthol, thymol, and eucalyptol, and the essential oils.

Atrophic Rhinitis (Dry Catarrh; Fœtid Catarrh; Ozæna).

This form of rhinitis, though less common than the moist and intumescent type just considered, is very frequently seen. Two types of cases should be distinguished: First, the *true atrophic rhinitis*, manifesting itself by the dry and granular appearance of the mucous surface and by the accumulation of dried secretions and scabs, which are seen filling the nasal passages. There is atrophy of all turbinated structures, the middle turbinated alone being sometimes excepted. Second, *pseudo-atrophic rhinitis*, a form simulating the former, in which there is a simple dryness of mucous surface and a shrinkage of the erectile structures of the nose and occurring only as an indication of a constitutional condition from any exhausting disease. The dryness and the apparent atrophy here are symptomatic of constitutional debility rather than a clearly-marked nasal affection.

Symptoms.—Atrophic rhinitis is characterized by three leading symptoms, viz.: atrophy of mucosa and bone, formation of a rapidly-drying secretion, and fœtor. With regard to the fœtor,

it does not seem due to the ordinary putrefaction of albuminous substances, but bears a specific character.

Loss of smell is not an infrequent symptom, and in my experience middle-ear catarrhs are more frequently associated with this form of rhinitis than with the moist type. Interference with nasal respiration is caused by the dryness and scabbing, and by the enlargement of the middle turbinated body, which frequently co-exists.

Study of eighty consecutive cases of ozæna shows that disease of the middle or internal ear is a frequent complication, occurring in 55 per cent. The middle ear was affected in thirty-eight of the eighty cases and the internal ear in eight, the disease of the former being attributable to closure or irritation of the Eustachian orifice, that of the latter to some constitutional cause, such as syphilis, tuberculosis, or infectious diseases which affect alike the nose and the internal ear. Ozæna was found chiefly in young persons, in women more than men; it was usually bilateral, fœtid in 90 per cent. of the cases, often affecting the naso-pharynx, rarely the larynx and trachea. In a few cases the middle turbinated bodies were hypertrophied or covered with mucous polypi, and in these there was suppuration from the accessory cavities. J. Morf (Arch. of Otol., No. 4, '94).

The diagnosis of atrophic rhinitis is not difficult even in its earliest stages, where nothing more is present than the commencement of dryness of the mucous surfaces. But it must be remembered that a condition of dryness of the mucous surfaces occurs in debilitated persons, which rapidly tends to self-recovery so soon as the general health is restored. But the common picture of a grayish mucous surface in the nostrils too patulous because of atrophied inferior turbinated bodies, combined with dried secretions attached to all prominent points in the cavities, will readily

distinguish this disease from other forms of chronic rhinitis. We have the moist and the dry varieties of rhinitis apparently combined in the same patient when a widely-deflected septum shows a moist condition of the mucous membrane in the narrow nostril, and a dry atrophied condition in the more spacious nasal passage. Atrophy seems to have taken place in such cases as a result of the overphysiological work performed by the larger of the two anterior cavities.

Etiology and Pathology.—In the etiology of atrophic rhinitis cause and effect seem to have been hopelessly confounded. It is an admitted fact that the shape of the nose is peculiar to the disease—that the nasal fossæ are ample and the turbinated bodies small; but while some authorities regard these changes as a part of an atrophic involution, others regard them as antedating the disease and contributing to its production. The fact that the nasal cavities in atrophic rhinitis are lined with squamous epithelium in place of the columnar ciliated variety has also appeared to me to influence the development of the disease. However, cumulative evidence seems to be on the side of the theory of a primary underlying deformity. The recently published essay by Meissner, in which many elaborate measurements were given, appears to prove that the flat, depressed nose of ozæna is a contributory cause, and not a result of the disease; and that the epithelial metaplasia by which pavement-epithelium appears in place of the natural columnar variety is a primary condition, and not the result of local disease. A somewhat analogous condition may be seen in the coarse skin and epithelial changes which play so prominent a part in causing many cases of acne juvenilis.

It seems beyond dispute that atrophic

rhinitis is a disease of the formative period of life, and that in most cases it has its beginning at a very early period, even the first few years of life. As in all similar affections, the leading question must be to determine whether atrophic rhinitis is actually congenital or acquired through the action of causes operating in infancy.

In 142 cases in private practice 80 were males and 62 females; the youngest was 6 years of age, the oldest 81; 58 were between 25 and 40 years of age, 37 were between 15 and 25, only three were under 10, 15 were between 40 and 50, and 8 were between 60 and 65. Of these cases, 55 complained of fœtor, more or less marked. In 47 the sense of smell was impaired, in 20 there was anosmia. In 28 of the cases the hearing was affected. Preceding history of the catarrhal condition before presenting themselves for treatment showed that they had suffered from seven to twenty-five years in 72 of the cases, and less than two years in 25. Only 8 of the cases showed signs of tuberculosis, 1 of them being laryngo-pulmonary tuberculosis; in 2 there was distinct scrofulous history; in 5 there was a history of syphilitic infection. J. E. Rhodes (*Jour. Amer. Med. Assoc.*, June 26, '97).

While Lowenberg's observations showing that the bacillus mucosus was present in all cases of atrophic rhinitis and is its primary etiological factor, it is only responsible for two disagreeable symptoms: fœtor and crusts. Cozzolino (*Annales d'Otol. et de Rhinol.*, Aug., '99).

A large number of microbes isolated from the nasal discharges of ozæna, and examined as to their pathogenic effect in animals. Fraenkel's diplococcus, streptococci, and pyogenic staphylococci, encapsulated, and bacilli were found to be devoid of pathogenic action. Whether inoculated together or separately, they gave rise to no specific disease in the nasal cavities of healthy animals. There is probably some primary anatomical lesion which favors the growth of the various organisms found. De Timani (*Il Policlinico*, Aug. 15, '99).

The specific cause of ozæna and rhinoscleroma has been a bacillus bearing close resemblance to the Friedländer bacillus. No biological or morphological difference could be detected on animal experiments and agglutination tests. In ozæna and scleroma the Friedländer bacillus merely finds favorable conditions for active proliferation, but it plays no part in the etiology of either disorders. F. Klemperer and M. Scheier (*Zeit. f. klin. Med.*, vol. xlv, Nos. 1 and 2, 1902).

An increasing number of experienced clinical observers ascribe atrophic rhinitis to the action of certain severe diseases during the first year or two of life, viz.: nasal gonorrhœa and inherited syphilis of an attenuated type. If this school of clinicians is correct in its views, the peculiar changes in the shape of the nose and in its epithelial lining would have to be attributed to the effects of one or the other of these diseases upon the undeveloped tissues of the child.

Gonorrhœa and syphilis have little in common and the coupling together of these affections in the etiology of a given disease may appear to be a forced attempt to connect disease with vice. As a matter of fact, however, both these affections provide a ready soil for the action of ordinary pyogenic germs. In long-standing urethral gleet it is not the gonococcus, but the staphylococcus, which we encounter. The syphilitic diathesis, whether it be congenital or acquired, offers special predisposition to suppuration. The two diseases then could contribute to atrophic rhinitis by producing a true purulent catarrh of the nose, which ought to produce far greater ravages than does ordinary catarrhal rhinitis, and produce them much more rapidly. It is quite conceivable that a purulent rhinitis in an infant could interfere with the onward development of

the turbinate bodies and at the same time practically destroy the mucosa.

With regard to the bacterial origin of ozæna aside from the possible rôle of the staphylococcus in infancy, it appears safe to say that, despite the several varieties of organisms identified with the disease by various investigators, all hitherto described play no further rôle in the disease than as elements of putrefaction or desiccation.

The bacillus of Abel is claimed by its discoverer and by others to be the actual cause of this disease. If a bacillus has been found which can generate the rapidly drying, fœtid secretions, the atrophy may be explained by the pressure effects of these tenacious scabs upon the mucosa. It is claimed that the ozæna which is caused by Abel's bacillus may readily extend to the sinuses and there cause suppuration.

Ozæna believed to be caused by an attenuated bacillus identical with that of Loeffler, but with virulence much lessened; this was found not only on the surface of the mucous membrane and in the exudate, but beneath it. It probably causes a chemical change in the secretion and a resulting atrophy. Bel-fanti and Della Vedova (*La Sett. Med.*, Apr. 4, '96).

In a series of 100 cases, examined with special reference to the Klebs-Loeffler bacillus, 20 were found having chronic atrophic rhinitis. These bacilli and others were found in 26 different cases, of which 11 were atrophic. The presence of the bacilli was attributed to infection, a pathological condition in the nasal chambers providing a suitable soil. Vansant (*Jour. Amer. Med. Assoc.*, Feb. 27, '97).

The important question of the etiology of atrophic rhinitis is therefore narrowed down to a single alternative: It is due purely to a congenital or inherited condition, or it is dependent upon a pathological process following

disease in infancy, viz.: a purulent catarrh which is a sequel of nasal gonorrhœa or a complication of congenital syphilis. If such a group is recognized there could be no possible reason for not including cases of scarlatina in which purulent rhinitis co-existed; nor, in fact, any other condition capable of contributing to the maintenance of this form of rhinitis.

The weak point of the staphylococcic theory is the almost complete absence of cases or statistics to support it. The next decade should witness the solution of this problem.

[Zuckerkindl, in the course of many autopsies on newborn children, failed to find any congenital anomaly like insufficient development of the turbinated bodies. The hypothesis, therefore, that these bodies are unable to present sufficient mucous surface to take up enough moisture to prevent the desiccation of the nasal mucus must be explained on some other ground than congenital defect. But we are naturally forced to admit that if this atrophic condition is not congenital it must be acquired in early childhood as a sequel of a purulent catarrh. CLARENCE C. RICE.]

While a certain degree of atrophy may follow a long-standing chronic rhinitis, true atrophic rhinitis is a disease *sui generis*, the nature of which still remains partly in obscurity. Like chronic rhinitis proper, it appears to be essentially predisposed to by some abnormalities of the nasal passages, not alone of its osseous frame-work, but of its epithelial lining, as well.

Treatment.—While atrophied tissues cannot be replaced by any medical or surgical treatment, it is encouraging to note that proper remedies can relieve the patients of the distressing local dryness and of the fœtid odor they exhale.

Although many drugs have been employed in the treatment of atrophic rhinitis, yet they have nearly all been

used upon the general principle of producing what is called by some "stimulation," by others "irritation." These two terms, I imagine, are alike in kind, differing only in degree. The German school, clinging to the belief that this disease is due to the presence of bacilli, advocate the use of solutions of bichloride. Koch tells of the great benefit and complete cure in some cases of atrophic rhinitis by the use of a spray of 1 to 4000 mercuric bichloride. Löwenberg always uses antiseptic douches of mercuric bichloride (1 to 4000), having first removed the crusts with warm saline solution. Thost applies bichloride of mercury in a solution of 1 to 2000 with a camel's hair brush twice a day. Many clinicians have adopted this measure.

Ten cases of ozæna treated with subcutaneous injections of antidiphtheritic serum. Treatment was first commenced by injecting subcutaneously 20 cubic centimetres of the antidiphtheritic serum prepared in the bacteriological laboratory of the Copenhagen University. This serum has a strength of about 100 anti-toxin units in each cubic centimetre. The dose was repeated a few days later. This dose was soon found to be too strong. By degrees it was found that 10 cubic centimetres was a proper dose for adults and 5 cubic centimetres for small children, the dose being increased now and then to 15 cubic centimetres in adults. It was found best to wait to repeat the dose until eight to twelve days have elapsed after the previous injection. Opinion is expressed that the injection of antidiphtheritic serum is the most effective remedy for ozæna yet known. Holger Mygind (Jour. of Laryn., etc., Aug., '98).

The use of the galvanic current recommended by Shurly has been praised. The positive pole is applied to the back of the neck and the negative pole in the nasal cavities. The faradic current has also been used, as have the copper electrodes, on the principle of electrolysis.

Experience with 6 cases of ozæna under treatment by electric light (incandescent). The light is directed by reflectors into the nose, or a lamp is actually introduced with a water-jacket into the nostril, or a larger lamp in the mouth is used, illuminating the nose through the transparent facial bones. In every case there was a noteworthy decrease of the crusts and secretion, and a disappearance of the characteristic fœtor. Two cases previously treated by the best means known, who had returned with the usual odor in spite of nasal douches several times a day, are now free of the odor and use no irrigation at all. Ign. Dionisio (*Gaz. Med. Ital.*, Feb. 6, 1902).

Among the drugs which have been employed in this way are iodoform, iodol, aristol, salicylic acid, camphor, iodine, perchloride of iron, tannin, alum, rhatany, and opium. Medicated bougies manufactured with a basis of gelatin and glycerin and medicated with the drugs just mentioned have been used a good deal in atrophic rhinitis, and this method by which drugs can be kept in contact with the mucous membrane for a long time seems to be a reasonable one.

The inhalation of stimulating volatile substances obtained from the essential oils and from cubebs, tar, eucalyptus, and thymol has also been largely employed; and we find in the shops a number of varieties of so-called autoinsufflators, by means of which the patient is enabled to blow into his own nostrils the fumes of carbolic acid, menthol, oil of pine, etc.

Among drugs which have given good results as stimulants in the treatment of atrophic rhinitis, thymol continues in the first rank; it may be used in watery solution with alcohol and glycerin, but is much better employed dissolved in one of the petroleum oils; albolene, glymol, or benzoinol may be used, the thymol being in the proportion of from 3 to 10 grains per ounce.

Frontal headache, lacrymation, or a

severe stinging sensation in the nose should always be regarded as indications for the use of a weaker solution. R. W. Seiss (*Med. News*, Nov. 28, '96).

One of the greatest discomforts experienced by these patients is the absence of resistance to the passage of the air through the nares. According to von Eckstein, this is obviated by the injection of paraffin under the mucous membrane. This restores the proper narrowings in the nasal passages, and lessens the discomfort, restoring to some extent the functions of the mucous membrane. The technique of paraffin injection in the nose is simple. The nose is carefully cleaned and cocainized. Where one injection is made, it is introduced into the inferior turbinated body. Commonly two injections are employed, one at the posterior end and one at the anterior end of the lower turbinate.

Twelve cases treated by the paraffin method. All showed distinct improvement, the relief from symptoms being very marked, although in no instance did a complete cure result. The only unpleasant sequelæ were pains in the frontal region in a few cases, which disappeared, however, in the course of a day. Hard paraffin, with a melting point of 50° to 52° C., is recommended as being most suitable and safest. H. Fliess (*Berl. klin. Wochen.*, Mar. 7, 1904).

A somewhat different plan of treatment, but intended to produce proper stimulation and secretion, is called "massage" of the mucous membrane. Laher, of Vienna, found this method of treatment most satisfactory. Cotton is wrapped around a probang introduced against the atrophic mucous surface and held in position by the left hand, while regular motion is made by vibrating the left arm with the right hand. After a few days normal secretion is established and the crusts become thinner and fewer in number.

The use of destructive agents in the

treatment of this disease deserves only to be censured.

The use of hydrogen peroxide seemed for a time to promise great amelioration in this disease, and as a germicide and disinfectant its ability is unquestioned. It is, however, rather troublesome to employ, and, while it produces cleanliness, is not a useful stimulant, but leaves the mucous membrane quite as dry as before. A strong solution is quite irritating and apt to produce a subacute nasopharyngeal catarrh.

One of the most valuable agents was obtained when the various oil preparations came into use. As protectives they are certainly sedative in their effect, and so allay irritation; as lubricants, they prevent the formation and retention of scabby crusts; as vehicles for stimulating drugs, they hold them in position for a much longer time than when watery solutions are employed. Many drugs have been used, in oily solution, in the treatment of atrophic rhinitis where disinfection as well as stimulation was desired, such as iodol, aristol, iodoform, etc.

In regard to nasal irrigation it is wise to employ the smallest quantity of fluid which will adequately clean the nasal passages, and, except in extreme cases of nasal ozæna, the post-nasal syringe is an adequate instrument. Sometimes patients succeed better in removing the dried scabs when they first spray oil into the nostrils.

There are not many cases in which the nasal douche-cup does not furnish sufficient fluid, if the saline solution is allowed to remain in the nostrils a few moments in order to separate the dry secretions from their attachments. This is a wiser procedure than using greater force with the fountain-syringe, or blowing the nostrils with great intensity.

When the nostrils are cleaned, if the middle turbinated body offers much obstruction or is wedged against the septum, it is desirable to make a channel between the two, and this can be done by removing the soft structures and perhaps a small part of the bony tissue with scissors. The snare is hardly a safe instrument, as it will sometimes remove the entire middle turbinated body; and with the crushing forceps more tissue is frequently taken away than is expedient.

It is most important to correct the granular surface of the mucous membrane, which frequently presents small ulcerative points where the scabs have been attached. Friction with a stimulating disinfectant is much better than applications of nitrate of silver or of any other drug.

The use of weak solutions of bichloride, or of 50 per cent. of borolyptol or of boroformalin, applied by rubbing the mucous surface with a hard cotton pledget for perhaps half a minute at a time, produces, after a few applications, not only an even surface, but a slippery one, whereas solutions of nitrate of silver nearly always leave the mucous membrane granular enough to retain the secretions.

After the washing at home and the stimulating friction at the office, the next most important procedure is suitable and constant lubrication with oils. No special advantage is obtained by incorporating the many drugs which have been mentioned in the oily solutions. Protection and lubrication are to be insured. The matter of stimulation is a very uncertain factor, and, if great stimulation is produced by pungent drugs, greater dryness results.

In those cases only where there is a tendency to subacute inflammatory attacks with discharge of watery secretion

should powders be employed. We see this condition in children in which a purulent rhinitis is rapidly assuming an atrophic state. A combination of 75 per cent. of compound stearate of zinc with boric acid and 25 per cent. of compound stearate of zinc with alum is especially useful. This powder should not be used after the discharge has been stopped and congestion controlled, as it tends to produce dryness. In the markedly congestive forms of atrophic rhinitis seen in immoderate cigarette-smokers and drinkers, this powder is also valuable.

Too much attention cannot be paid to the improvement of the general health, particularly by fresh air and healthful exercise. Ziem ordered his patients to the sea-shore or to the woods for a certain time each day, in order that they might, as he expressed it, "thoroughly ventilate their nostrils." Probably the sea-shore is better for these cases than the mountains.

By far the greater number of cases of nasal purulent discharge appearing as ozæna are referable to affections of the sphenoid and ethmoid sinuses. Fœtor, atrophy, and crust-formation may also be expressions of a number of causes. Hence treatment of ozæna can only be rational when applied to its primary cause. Since these are mostly sphenoidal or ethmoidal, the therapy of ozæna must be a surgical one. Nobel and Lohnberg (*Berliner klin. Woch.*, Mar. 26, 1900).

Series of 10 cases in which interstitial injection of paraffin into the inferior turbinated bones were tried, Eckstein's paraffin with a melting-point of 60° C. (140° F.) being employed. By this means an artificial hypertrophy of the inferior turbinated bones was produced, and in the cases so treated the crusts disappeared in a few days and odor subsided. Such reconstruction of the inferior turbinates seems to have effected a complete cure in every instance, but further time should elapse before inter-

stitial injection of paraffin can be declared a radical cure for that most obstinate affection. A. Brindel (*Jour. de Méd. de Bordeaux*, July 27, 1902).

Series of cases in which paraffin injections were successfully employed to restore the inferior turbinate body in the treatment of atrophic rhinitis. A white paraffin with a melting-point of 105° F. (40.4° C.) was employed. Lake (*Lancet*, Jan. 17, 1903).

Tumors of the Nasal Cavities.

Mucous Polypi.—Polypi, while usually classed under the head of new growths, are now generally believed to be of inflammatory origin. They are generally multiple and often bilateral. The great majority of them originate from the mucosa covering the middle turbinated bone. MacDonald describes polypi as ordinary inflammatory products peculiarly modified by the physical conditions in which they exist. The most striking feature of the polypus is its tendency to absorb and retain moisture, which gives to it its œdematous, transparent, jelly-like character.

Symptoms.—The symptoms are primarily those of obstructed nasal passages. Rhinitis is present, the patient constantly taking fresh colds. During the day the patient sniffs or attempts to force air through the nose from behind, while at night he usually snores loudly. Local reflexes are often present, such as cough or lacrymation, while cerebral symptoms often occur, including dizziness and aprosexia. The sense of smell is obtunded or lost. All of these symptoms are much aggravated during cold weather. In long-standing cases asthmatic symptoms frequently occur. But whether they are occasioned by a congestive bronchitis or are simply reflex phenomena referable to nasal disturbances it is not always easy to determine. Numerous cases of hay fever have been reported in which polypi were

present and yet there was no bronchial disturbance. But, as a rule, if the polypi are of long standing, pharyngeal and bronchial catarrhs are apt to be present.

The amount of nasal discharge may be copious, and it may be thinner than the discharge of ordinary rhinitis; in fact, the thin, profuse, watery discharge known clinically as naso-hydrorrhœa is occasionally a symptom of polypus. Speech is peculiarly modified.

All the symptoms of polypi are aggravated during wet weather on account of the capacity for absorbing moisture possessed by this variety of growth.

Polypi may, under certain circumstances, cause obstructive symptoms of the ostium maxillare, nasal duct, and Eustachian tube. According to Grünwald, pus is present in about 86 per cent. of all polypi, while the presence of a polypus usually implies sinus disease.

Diagnosis.—The existence of a mucous polyp or polypi can be suspected by the symptoms of long-continued nasal obstruction, the nasal discharge, the peculiar hollowness of the voice, and the motion of these growths, which is easily appreciated by the patient. An examination of the nostrils, however, quickly shows a white, transparent, glistening enlargement, which resembles no other growth, unless it is adenosarcoma. It is probably true that mucous polypi sometimes degenerate into a form of nasal sarcoma. In some instances the appearance of the two growths resemble one another, and this is most apt to be true when mucous polypi have regrown several times, because congestion increases with each regrowth of the mucous polypi and they contain more connective tissue and blood-vessels at each regrowth.

Sarcoma of the nasal passages pre-

sents a granular surface, bleeds easily, crumbles away in pieces when attempts are made to remove it, and frequently involves the antrum and occasionally the orbit.

Etiology and Pathology.—While the inflammatory origin of polypus is generally conceded, it is impossible to state why they do not occur with equal readiness in all cases of chronic rhinitis affecting the middle turbinated. With regard to the relation of polypus to ethmoiditis, this association has often been recorded. There does not seem to be any radical distinction between the œdematous granulations which accompany ethmoidal disease and polypi which are unaccompanied by the latter malady. Polypi often contain fragments of bone which would seem to show that the formations originate from the fungoid granulations associated with ethmoidal disease.

It was formerly supposed that development of mucous polypi was primary, and suppuration of the ethmoidal, as well of the maxillary sinus, secondary to these growths, the explanation being that the presence of polypi either produced an aggravated rhinitis or else mechanically closed the nasal openings into the maxillary sinus and the ethmoidal cells and thus produced a suppurating inflammation. It is generally felt, however, that the reverse is true, and that mucous polypi are of inflammatory origin and the result of a chronic middle turbinal rhinitis and ethmoidal disease. The character of this ethmoidal disease is, as a rule, simple in its commencement; but, as the result of enlargement of the middle turbinated and of the development of this œdematous granulation-tissue, or of polypi, suppuration usually occurs later.

Nasal polypi are not myxœdematous growths, but pendent tissue in the nose,

which has assumed that shape because of the effusion of serum into it from the blood-vessels. While in the fluid of a polyp there is some mucin derived from glandular structure the polyp may contain, and here and there by careful focusing an occasional embryonal new connective-tissue cell may be seen, there is little or no new formation of tissue, but on the contrary a separation of the fibres of the pre-existing subepithelial stroma by serous effusion. Jonathan Wright (Med. Record, Jan. 26, 1901).

Pedunculated polypi and the condition of thickening on the anterior face of the middle turbinated formerly termed "sessile polypi" are histologically identical, differing only in their œdematous quality. Polypi occur much more frequently in men than in women and are rarely seen in patients under the twentieth year.

Treatment.—The old method of operating by traction with forceps is no longer in vogue. The removal can be much more easily and thoroughly effected by means of the cold wire-snare. A 5-per-cent. solution of cocaine is sufficient to relieve pain and to reduce congestion and swelling so that the polypi may be easily seen, grasped, and removed. Very little bleeding follows their removal, but it is better to tighten the cold snare slowly in order that the polypi may be removed at their attachment. Three or four operations are sufficient to clear both nasal passages. The thickened tissue covering the middle turbinated bone can be excised with nasal scissors and removed with the cutting-forceps.

After the polypi have been taken away the nasal passages should be irrigated at least twice a day with proper disinfectants used with a post-nasal syringe. The patient should visit his physician at least once a month in order to ascertain if there is any attempt at

regrowth, and that it may be prevented by the application of the galvanocautery to the cicatrix. After careful cauterization there is often no disposition toward regrowth. In removing polypi as little as possible of the normal structures of the nose should be sacrificed in order to prevent the development of chronic purulent rhinitis.

In considering the prognosis in cases of mucous polypi, it should be remembered that these growths are inflammatory swellings resulting from a middle turbinated and ethmoidal inflammation. After they have been entirely removed, therefore, there remains enlargement of the middle turbinated bone itself, and extensive tissue thickening on the anterior, posterior, and the internal face of the middle turbinated. The portion wedged in between the middle turbinated and the septum may require reduction or complete removal. A portion of the middle turbinated bone itself will perhaps require to be taken away, in order to obtain nasal respiration and drainage and to reach the seat of suppuration in the anterior ethmoidal cells and to relieve the painful symptoms which accompany a suppurating ethmoiditis. While it is safe to promise the quick removal of mucous polypi, it should be remembered that the patient is frequently left with a chronic rhinitis not easily corrected.

Miscellaneous Tumors.—**FIBROMATA** originating in the anterior nasal cavities proper are exceedingly rare. Indeed, it is probable that the majority of cases reported as such were mistaken for other growths. Removal with the wire snare is the only measure indicated.

PAPILLOMATA.—These wart-like growths are somewhat less rare than the former neoplasms. They are usually situated in the anterior portion of the

septum or wall, or on the floor of the nasal cavity. They may grow sufficiently to cause obstruction and bleed easily. They are readily removed with the snare.

CYSTS.—These growths are occasionally met with in the nasal cavities at the anterior end of the middle turbinated bone. They usually contain yellow, viscid liquid. They cause obstruction and sometimes quite severe pain, and are often associated with mucous polypi, from which they differ by their hardness. They may either be perforated by means of the burr or trephine, or cut off with rongeur forceps or a strong wire snare.

SARCOMATA can no longer be considered as rare, judging from the number of cases reported. Repeated epistaxis, increasing obstruction and pain at the brow, sometimes radiating to the temple, are the most prominent symptoms. The growth being usually located in the upper part of the nasal cavity involved, orbital pressure may occur,—exophthalmos, widening of the bridge of the nose, etc., being occasionally produced.

When the growth can be reached, removal with the snare and subsequent curetting are sometimes possible. But often the location of the tumor is such as to expose the patient to meningitis, even if simpler measures such as cauterization by chemicals or the cautery are tried.

The writer reports four new cases of sarcoma of the nasal passages. His series of 150 cases includes nearly all of the 111 cases reported by Gibbs and Bosworth. It would seem from these cases that sarcoma of the nasal chambers has a less malignant tendency than when occurring elsewhere. Treatment is surgical or by Coley's toxin. Intra-nasal operations, according to the author, give better results than the extremely radical extranasal ones.

Watson (American Medicine, Apr. 2, 1904).

CARCINOMA seldom develops in the nasal cavities. It resembles sarcoma in its development, though hæmorrhage is apt to occur later. Removal, when the diagnosis has been proved by microscopical examination, is useless.

Septum, Diseases of the.

Abscess.—Abscess of the septum is by no means rare. It is usually due to a blow on the nose, but may, though seldom, be idiopathic or associated with perichondritis or erysipelas. The traumatic abscess is usually a suppurating hæmatoma, the formation of pus having been antedated by the extravasation of blood from the effects of the blow.

Occasionally abscess of the septum is a complication of nasal diphtheria and scarlet fever. It has been noted in children as a result of foreign bodies, and it may be caused by sepsis through any abrasion, occasioned, for example, by uncleanly methods of treatment. It occasionally follows the use of the galvanocautery on the nasal partition, but it very seldom complicates a wound produced by the saw or any cutting instrument.

The most frequent seat of septal abscess is the anterior, inferior part of the septum, and when of traumatic origin is generally bilateral. The majority of cases occur in children.

Symptoms.—The abscess does not appear, as a rule, until a considerable time after the blow or fall. After the period of incubation the pus forms rapidly and the tumefaction quickly obstructs the nose.

In the acute cases the nose is painful and swelled and the congestion may even extend to the cutaneous surface. Examination with the nasal speculum

shows the nasal openings closed, usually on both sides, by red swellings, which can be easily retracted by the pressure of the probe. Sometimes it requires the use of cocaine to determine that the swellings are a part of the septum and not attached to the turbinated wall. It is important to remember that cocaine does not reduce abscess-swellings of the septum as it does turbinal congestions.

Perforation of the septum rarely results from an abscess unless long neglected or treated unscientifically. But there is danger of weakening the anterior support sufficiently to occasion some depression at the tip of the nose.

Treatment.—The abscess should be punctured with a narrow-bladed knife after cocaine has been applied. The nostrils should be irrigated with a 1 to 4000 mercuric bichloride or a 25-per-cent. solution of boroformalin. Recovery, as a rule, is very rapid.

HÆMATOMA.—In most cases of traumatic abscess an extravasation of blood occurs directly after the injury, and forms a *nidus* for the development of the future abscess; but we may have abscesses without previous hæmatoma, while hæmatoma does not always suppurate.

Deviations of the Septum.—Anomalies of the septum, while almost universal in frequency, are able to cause such serious inconvenience and harm in many cases that it is best to regard them as pathological, especially as their rectification is followed by decided improvement.

The departures from the normal are of two kinds, viz.: local thickenings, which are spoken of as *spurs* or *crests* according to their extent, and *deviations*, in which the septum is simply bent in one of many possible ways.

Symptoms.—Many of the minor degrees are quite free from active symptoms, and even in severe forms the external deformity may be the chief sign of abnormality. When symptoms are present they assume the form of nasal obstruction and catarrh; as already stated under the head of chronic rhinitis, that condition appears, in the majority of cases, to depend almost entirely for its chronicity upon septal anomalies.

The symptoms of obstruction do not differ from those due to nasal stenosis from other causes.

In some sigmoid deformities both nostrils may be obstructed. The contact between a deviated septum and the turbinated side of the nose produces a chronic congestion probably quite as much from irregular atmospheric pressure-effects as from simple irritation, which give rise to repeated attacks of rhinitis. As a result of a general nasal catarrh, pharyngeal and laryngeal inflammations develop. The local disorder progressing slowly, the patient does not consult the rhinologist until he suffers great inconvenience from nasal obstruction.

In addition to the ordinary deformity,—one side of the nose being more prominent than the other, and the tip of the nose turned from the middle line of the upper lip,—the anterior cartilage is so enlarged and bent as to show prominently in one or other of the nostrils.

The character of the deviation can be determined by using the nasal speculum: a convexity will be found in one nostril, its long axis running vertically, horizontally, or obliquely, and a corresponding concavity in the other. There is usually a large amount of extra thickening at the point of greatest convexity. In the concave nostril prominent spurs and crests are frequently seen running

horizontally along the sutural ridge which binds the septum to the superior maxilla.

Etiology.—In spite of the fact that the rhinologist constantly sees abnormal conditions of the nasal septum, and has an unlimited opportunity for studying them, it remains true that in the majority of instances it is difficult to determine the exact causes of septal deviations. Sir Morell Mackenzie examined 2150 skulls, and of these a little more than 76 per cent. presented some degree of deviation: 38 per cent. to the left, 28 to the right, and the remainder irregular.

It is usually a matter of more or less conjecture whether in a given case the deviation has been occasioned by congenital causes or errors of development in very young life, or the pressure-effects of hypertrophy of some other bony portion of the nose,—as, for instance, pressure of the middle turbinated upon the septum,—or whether it is caused by the large variety of traumatic influences. Undoubtedly, in many instances several of the factors named have exerted an influence. In a large majority of the cases of thickening of the partition resulting in spurs and crests, the etiology cannot well be defined unless we are willing to be satisfied with the results of simple catarrhal inflammation. Many observers are content to believe that traumatic causes are the most frequent. Hardly a case appears in which there is not some history of a blow or fall. But actual fracture or dislocation of the septum is not a common occurrence, and blows are rarely so severe at the time as to produce deformity. Still, the fact that men are much more commonly affected than women, would tend to sustain the traumatism hypothesis.

Post-nasal adenoids and the subse-

quent frequent attacks of acute catarrhal rhinitis are probably the most potent factors in causing deviation of the septum, the sequence of injurious results being as follows: The post-nasal space filled with lymphoids; nasal stenosis; chronic mouth-breathing; the cheek-muscles extended and pressing hard upon the superior maxilla diminish the lateral diameter of this bone, force upward the arch of the hard palate, and so shorten the vertical measurement between the base of the skull and the roof of the mouth in which the nasal partition must develop. The shortened diameter necessitates curvature of the nasal partition upon itself in one of the many forms. Perhaps traumatism is frequently added as a cause to the above conditions.

When a nasal septum is widely deviated from the median line and there is no history or evidence of post-nasal adenoids, and the roof of the mouth is not high, we may believe that traumatism has probably been the cause of the mischief. Enlargements of the middle turbinated bone are sometimes sufficient to push over the bony part of the nasal partition. Hypernutrition of any portion of the septum, especially along the sutural lines, produces congestion and local thickness: spurs and crests. Irregular development from different centres of growth would be sufficient to distort the nasal septum from a straight line.

Again, a single nasal passage may be blocked, which tends to a greater development of the free nostril and a deviation of the partition toward the occluded side.

Of 1050 patients indiscriminately examined personally, only 100 had normal noses; that is to say, fairly vertical septa and symmetrical nasal cavities. The ages of the patients varied from one

year to eighty. It was rare to find any obstruction, unless due to temporary causes, below ten years of age. The above statistics showed that nasal obstruction was seldom or never congenital, was rare below ten years of age, and was more common after puberty. If from any cause—*e.g.*, paralysis or paresis of the nasal dilators, injuries, inflammations of cartilage, enlarged inferior turbinals, polypi, catarrh, etc.—one nostril becomes blocked up, the stream of air passing out of the one nasal cavity into the lungs exhausts the air in the closed nasal cavity, with the result that the walls of the nasal chambers become acted upon by a pressure exactly in proportion to the degree of rarefaction. Hence we have varying degrees of septal deviation and pinched and approximated upper maxillary bones, while upon the palate the effect is to produce high-arching, with consequent irregular eruption of teeth. Mayo Collier (Med. Press and Circ., Nov. 20, '95).

Treatment.—Fortunately, in a large majority of instances the patient consults the rhinologist, not to have the external deformity corrected, because it is not sufficient to be a matter of much importance, but rather to have the obstruction to nasal respiration removed. It is again fortunate that usually the partition is so thickened that enough of the convex side can be removed to secure ample breathing space without perforating the septum, and without the necessity of the more severe operation of fracturing the nasal partition. Nearly every rhinologist has devised some instrument for the removal of a portion of the nasal septum, or for its forcible replacement in the median line. The saw is probably used more than any other instrument, and it is especially applicable to cartilaginous deviations, which are the most common variety. Nasal saws have not, up to the present time, been made sufficiently strong so that bony deviations or enlargements

can be easily excised with them. Enlarged antero-posterior sutural ridges which fill the inferior meatus are best removed with stout scissors or with a trephine. Small spurs can be reduced by a galvanocautery-puncture, and sometimes with chromic acid. Electrolysis is also recommended by various clinicians.

Conclusions from 21 cases in which electrolysis was used as a treatment for deviations, spurs, and ridges of the nasal septum: (*a*) The results are favorable in most cases, but the method is neither so simple nor so sure as the usual surgical means. (*b*) It should be limited to those cases in which it is impossible to carry out surgical treatment, either on account of the disinclination or disability of the patient. (*c*) Electrolysis requires an experienced specialist to carry it out. (*d*) Cartilage yields more readily than bone. (*e*) Osteoma is more easily removed than normal bone. (*f*) Only growths of small size are successfully removed by electrolysis. (*g*) Perforation and sloughing result from the use of too-powerful or too-prolonged current. (*h*) Ten to 27 milliampères of current were used for a time, varying from twelve to twenty-seven minutes. W. L. Ballenger (Jour. Amer. Med. Assoc., Jan. 11, '96).

There is no single operation suitable for all cases of deflection of the nasal septum. Each case should be a study unto itself and the judgment of the surgeon must determine the operative measure best suited to that particular case. The Asch operation is eminently satisfactory in the large number of cases in which the cartilaginous septum is alone deflected. Osseous deviation and cartilagino-osseous deviations are not suitable for correction by the Asch method.

Deviations of both the cartilaginous and osseous septum offer the most difficult problem to solve, and no one operation meets every indication, but in many cases the Watson-Gleason operation, modified to suit the case, offers a good chance for success.

Careful observation will discover a fair proportion of cases in which the

removal of spurs, either cartilaginous or bony, or both, will accomplish the best result; and it is more desirable to attain the result by this method than by the more formidable division of the septum. There are a certain number of cases which must be classed as inoperable. Perforations occur in about the same number of cases in all operations in which an entire division of the tissues of the septum is effected.

J. S. Gibb (Journal of the American Medical Association, October 29, 1904).

Much has been written about the advisability of first taking away the mucous covering before excising the cartilage in order not to sacrifice mucous membrane, but thus far attempts in this direction have not been very successful. When the nasal saw is used the patient's head should be turned toward the affected side in order that the convexity of the cartilage may be made as prominent as possible. The beginning of the incision can be made with the saw almost at right angles to the septum. After the cutting has been commenced the saw can gradually be turned so that the teeth are downward. When the cut has been carried down to the sutural line and the bone is reached, time will be saved by finishing the incision with nasal scissors and removing with forceps. Thorough washing of the nose before the operation is required, but after the section has been completed it is better to keep the wound covered with compound stearate of zinc and boric acid for at least two or three days. Attempts to keep the nasal passages in anything like an aseptic condition will prove a failure, and there is much more likelihood of septic symptoms when the nostrils are frequently washed than when the nasal wound is protected by boric acid or some other equally-good germicide.

After using the powder a few days, the nasal passages can be washed and

oiled. The scar-tissue at the point of sawing can be made moist and slippery by resorting to massaging with a stimulating disinfectant, such as boroformalin.

I use the cautery or chromic acid only when there are small points to be reduced. Asch's operation, in which the septum is cut through and forcibly carried to the median line, is indicated when the partition is so thin that it cannot be sufficiently excised and so it becomes necessary to carry the entire septum in the median line. Two different-shaped scissors are employed, the one to cut through the bent septum in a horizontal line, the other at right angles to the first cut in a vertical line; the four points are then pushed through from the convex side into the concave side, so that the redundancy of tissue can overlap in the wider nostril. The entire partition is then forcibly carried to the median line with a large pair of flat-bladed forceps, and the septum is retained with cork or celluloid nasal tubes, which can be removed daily, and the nasal passages cleaned. The bleeding is profuse when the cutting is made, but usually ceases quickly. The local application of a solution of suprarenal extract may be used to prevent this, however.

Aqueous extract of suprarenal capsule is a powerful local vasomotor constrictor, and a contractor of erectile tissue; it is safe to use in a very considerable amount, without dangerous or deleterious effects locally or as regards the general constitution. These effects can be produced any number of times without entailing any vicious habit, either in the tissue or in the individual. It seems to heighten the effect of any drug used locally after it. In acute congestions it has its widest application and greatest opportunity for good, but in certain chronic conditions of the hay-fever type, when redundant tissue seems

prone to develop, it can be relied upon. H. L. Swain (Med. Record, May, '98).

Use of the suprarenal gland, in the form of an aqueous extract freshly prepared, advised. Ten grains of the dried gland mixed with 2 drachms of water and filtered will form a 10-per-cent.-solution filtrate. This aqueous extract is the most powerful astringent known. It has been of great value in treating inflammatory conditions of the eye. For inflammation or congestion of the mucous membrane of the ear it is of great value, as well as for inflammatory conditions of the nasal passage. It has been used to advantage for stricture of the urethra, for certain skin diseases, for pernicious anæmia, for Addison's disease, for exophthalmic goitre, and as a tonic to the heart-muscle. It is best administered by placing a few drops of the extract on the tongue. Bates (Med. Record, Oct. 8, '98).

In all cases where the turbinates have been cauterized with electricity the operations have been followed without the loss of blood. Removal of spurs of the septum have become under its use practically bloodless. The nose is cleansed with an alkaline solution; a 4-per-cent. solution of eucaine is then applied upon a pledget of cotton, which remains *in situ* for five to six minutes, then removed; this is followed by a 4-per-cent. solution of the suprarenal capsules applied to the surface in like manner. W. F. Southard (Pacific Med. Jour., Nov., '98).

Suprarenal extract has two distinct actions on the mucosa of the respiratory tract: it blanches the tissue, and at the same time constricts it. The blanching effect is not so great in the larynx and pharynx as in the nasal cavities. The drug acts only on mucous surfaces, and its influence is absolutely local: no tissues are affected except those in contact with the drug. Personal mode of application is as follows: The parts to be operated upon are covered with a pledget of cotton saturated with the adrenal, which is allowed to remain for five minutes. This is removed and a solution of cocaine or eucaine of whatever strength desired is applied in the same manner for a similar length of time.

This is also removed and a fresh piece of cotton with the adrenal solution is again pressed against the tissues for another five minutes, and when this is removed it will be found that the parts are perfectly bloodless and totally anæsthetic. The operation can then be readily performed. The duration of its effect depends much upon the method of application. The majority of cases will show some anæmia of the mucosa from one to five hours after the application of the drug. It has no anæsthetic influence, but it tends to prolong the anæsthesia of cocaine when combined with that drug. Seymour Oppenheimer (N. Y. Med. Jour., Aug. 18, 1900).

The nasal tube in the wide nostril is not needed more than a day or two, but is kept in the narrow nostril for two weeks.

There is apt to be a slight rise of temperature the second and third days, and possibly an acute pharyngitis. This operation should not be performed unless there is external deformity which needs correction. It should rarely be performed if sufficient breathing space can be secured by excising a portion of the septum.

Perforation of the septum in adults not regarded as a serious accident, because the supporting structures of the nose are developed and will maintain their position. But in children, where the nasal structures are imperfectly developed and still in the process of growth, perforation of the septum is quite liable to cause a falling in or depression of the top of the nose, and particularly in the cartilaginous portion. The intentional perforation of the septum, because it is deviated or deformed, should never be resorted to. J. O. Roe (N. Y. Med. Jour., Dec. 1, '94).

Perforations of the nasal septum, situated near the posterior edge of the cartilage of the septum, and of not too great a size, are seldom of any serious pathological importance. There is a class of perforations, however, which is deserving of more attention than has

heretofore been given to it, namely: the more or less extensive injuries sometimes produced in the course of operations on the septum, and involving a loss of substance in the vomer. Such an accident is apt to occur during the attempted removal by means of the saw of what appears to be a septal ridge, but what in reality is a sharp horizontal deflection of an unusually thin septum. Instead of a ridge being removed, a long narrow opening, parallel with the floor of the nose, is made between the two nasal cavities. In several cases coming under personal observation in which this accident occurred, the patient suffered marked symptoms of general shock, quite out of proportion to the apparent importance of the injuries inflicted. Delavan (*Jour. of Laryn.*, Feb., '95).

Two hundred operations for deviated septum performed by Asch's method. Of these cases, 85 per cent. resulted in the complete straightening of the septum, while in the remainder some degree of deflection was retained, but in no case was this sufficient to cause any stenosis or discomfort; so that in all a cure may be said to have followed, as far as symptoms are concerned. Perforations of the septum occurred in about 2 per cent. of the cases, but they were only of the size of pin-heads. Mayer (*Med. Rec.*, Feb. 5, '98).

New operation for deviations of the nasal septum consists in sawing a U-shaped flap around the deviation, base upward, then pushing that flap upward into the unobstructed passage so as to break the resiliency of the cartilage, and then allowing it to drop down over the opening like a trap-door. No support by pins or tubes has usually been required. E. B. Gleason (*Phila. Polyclinic*, No. 34, '98).

A simplified operation—a combination of those of Roberts and Moure. After cocaineizing both sides of the nasal septum a stout darning needle is introduced into the free nostril and passed through the septum on the concave side anterior to the concavity. Having passed through to the other side it is then used as a lever to press back the convex part into the concave side, and is then passed

back through the septum so as to retain it in this position. Nitrous-oxide gas is now administered and Moure's shears introduced; the cartilage is cut through horizontally below the deflection, and then obliquely in front of it and above it, parallel to the ridge of the nose, the incisions not meeting below and in front. The cartilage is then manipulated at the incisions so as to encourage overriding, and the needle is left *in situ* for a week, a piece of rubber tubing being placed over it, to lessen the pressure on the soft parts in front. When the deflection is accompanied by any considerable amount of thickening, this should be shaved off beforehand, preferably at an interval of a couple of weeks, though it may be done at the time. Dundas Grant (*Brit. Med. Jour.*, Aug. 30, 1902).

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NASAL NEUROSES. See RESPIRATORY ORGANS, NEUROSES OF.

NASO-PHARYNX, DISEASES OF.

Post-nasal Adenoid Growths (Adenoid Vegetations).

The recognition of this condition has been of inestimable value to humanity. To Wilhelm Meyer, of Copenhagen, is due the credit of having first brought the subject in its clinical and pathological aspects before the medical world.

Symptoms.—Among the earliest symptoms characterizing post-nasal adenoid hypertrophy is obstruction to nasal respiration. The naso-pharyngeal stenosis may be partial or complete, this depending upon the size and position of the vegetations and upon the accompanying inflammation. Even with partial occlusion, however, the patient often finds it more comfortable to breathe, at least partially, through the mouth. Dryness of the throat on waking is often complained of. This is due to the mouth-breathing, and forms the source of various pharyngo-laryngeal disturbances.

Among 4080 patients suffering from affections of the nose, throat, or ear, 426 had adenoid tumors in the vault. Of these 69 per cent. had symptoms of nasal obstruction; 37 per cent. suffered with tonsillitis or pharyngitis; 59 per cent. had ear complications, of whom 110 were cases of suppurative otitis and 142 were cases of deafness without suppuration. Y. Arslan (Jour. of Laryn., etc., Dec. '95).

Still, cases are sometimes seen that breathe with the mouth closed despite the presence of vegetations.

In infants nursing is often hampered in consequence of the obstruction, and cleansing of the nose is rendered difficult, owing to the fact that the expiratory current is interrupted by occlusion of the upper pharynx.

The voice is usually altered. The impairment is occasioned by an interference of the passage of the waves of sound through the post-nasal space. Stuttering has also been ascribed in some cases to post-nasal obstruction. The tumor sometimes causes a sensation suggesting the presence of a foreign body in the nasopharynx or at the back of the throat which cannot be got rid of by any effort on the part of the patient. Headache is sometimes complained of.

Associated with adenoid vegetations is a condition known as *aproxia*, or lack of ability to concentrate attention. Sleep is often disturbed and the child grows "nervous" and irritable. Attacks of suffocation during sleep occur occasionally, out of which the patient is aroused exhausted and in a state of profuse perspiration. The mouth-breathing is usually noisy, and snoring is not infrequent. Night-terrors are sometimes witnessed. Enuresis is often traceable to post-nasal growths.

Cough due to laryngeal irritation brought on by constant buccal breathing

usually persists as long as the nasopharyngeal vault remains occluded.

Children in whom adenoids exist are more susceptible to croup, laryngitis, bronchitis, and pneumonia. F. A. Bortome (N. Y. Med. Jour., May 22, '97).

Deafness or impaired hearing in early life without doubt has its source in post-nasal adenoid hypertrophy in the majority of cases. Normal or perfect ventilation of the tympanic cavity is impeded, which condition may ultimately lead to retraction of the membrana tympani and induce tinnitus aurium. The cause and course of chronic otorrhœa to which so many children are subject, especially those of the scrofulous or tuberculous temperament, are very frequently referable to adenoid vegetations. Inflammatory states of the lymphoid tissue induced by exposure to temperature-changes or the exanthematous diseases generally produce catarrhal affections of the Eustachian tube or of the mucous membrane lining of the tympanic cavity, which may end in a chronic suppurative process of the middle ear, accompanied, as the case may be, by mastoid complication. Frequently an earache is the result of pressure exercised on the Eustachian cushion or orifice by adenoid growths, causing hyperæmia and irritation of the tube.

Out of 565 cases treated for nasopharyngeal affections, diseases of the middle ear were found in 197. Of the whole number, 134 had hypertrophy of the third tonsil, of whom 62 had impaired hearing. White (Jour. Amer. Med. Assoc., Aug. 3, '89).

Deafness found in 90 per cent. of children having adenoids. A. Bronner (Brit. Med. Jour., Sept. 13, '90).

Of 160 deaf-and-dumb patients, 57.5 per cent. had adenoid vegetations of the pharynx. Wróblewski (Inter. klinische Rund., Oct. 11, 18, '91).

Of 415 young deaf-mutes, 79 were found to have adenoid vegetations of the vault, causing partial occlusion of the cavity or pressure upon the Eusta-

chian openings. Arthur A. Bliss (Med. News, Nov. 19, '92).

Out of 500 cases, 304 were more or less deaf, while in 196 the hearing was normal. Of these 304, 22 were deaf in one ear only. The most common form of ear complication is undoubtedly Eustachian obstruction, occasionally associated with the presence of free exudation in the middle ear. In 98 cases there were, however, evidence of past or present middle-ear suppuration. In 25 instances earache was a prominent symptom. The hypertrophied pharyngeal tonsil probably acts (1) by causing obstruction of the Eustachian tube, (2) by interfering with the circulation [lymphatic or vascular] of the middle ear, and (3) by acting as a *nidus* of infection in suppurative cases. P. McBride and A. Logan Turner (Edinburgh Med. Jour., May, '97).

Among 1087 children, 138 mouth-breathers were found, and in 114 of these adenoids were the cause of the mouth-breathing. On an average, among 1000 patients, there were 127 in whom adenoid growths required removal. Alfred Decker (Jour. of Larynx, etc., Apr., 1900).

The percentage of adenoid cases seems to differ widely in different countries. Among the writer's patients suffering from ear, nose, or throat trouble the author found 6 per cent. suffered from adenoids. In the etiology, heredity seems to exercise a marked influence; dampness *per se* does not seem to play a very important part; bad hygienic surroundings, tuberculosis, and hereditary syphilis, rickets, zymotic diseases, each have a more or less marked influence. They have also been attributed to degenerative processes in the nervous system, to the disturbances of the thyroid, etc. Of all the symptoms due or attributed to adenoids, the most important are those relating to the ear—for example, deafness, otorrhœa. In children the commonest type is that of catarrhal otitis; in adults, hyperplastic sclerosing otitis. Skeletal alterations in the upper jaw are often present as a secondary result. The first deleterious effects of adenoids on the auditory apparatus usually start in the middle ear,

and afterwards on the internal, which may be damaged *via* the blood vessels or the lymphatics. Earache, again, may be due to adenoids. Where surgical interference is postponed, palliative treatment by nasal douches and politizing may be tried. For removal the author prefers local cocaine anæsthesia (10 to 20 per cent.), or general anæsthesia by ethylic bromide. The post-operative treatment is purely hygienic (keeping to the house and closing the nostrils with sterile gauze). The operation is contraindicated by the presence of hæmophilias, any marked dyscrasia, epidemic disease, or tuberculosis. Grazi (La Clin. Mod., An. 9, Nos. 4, 5, 6, 7; Brit. Med. Jour., Nov. 12, 1904).

Blood sometimes appears in the mouth or on the bed-clothing during sleep; this is occasioned through the friability and vascularity of the growth, rupture of the tissue being easily induced by slight mechanical interference either by the action of the soft palate on the vegetations or by friction between the growths themselves.

Laryngitis stridulus, or so-called "false croup" or spasm of the larynx, an affection suddenly manifesting itself some time after midnight and causing alarm, is mainly ascribable to naso-pharyngeal occlusion and buccal respiration. The larynx becomes dry and hyperæmic, which in a neurotic individual produces reflex phenomena.

Among other reflex conditions referable to post-nasal growths are choreiform movements of the soft palate accompanied by a peculiar clicking noise, audible at a considerable distance from the patient and occurring at intervals of one second. I witnessed a case of this character cured by a thorough removal of the naso-pharyngeal lymphoid mass. I also witnessed wryneck as a complication in three cases. Prolonged buccal breathing incident to retronasal obstruction may also lead to chronic enlargement of the

faucial tonsils and prominence of the palatine arch.

In adults many symptoms characterizing the disease in childhood are present and, in a great measure, give rise apparently to similar disturbances, among which chiefly to be noted are catarrhal states of the neighboring mucous membranes, dry pharyngitis, and chronic naso-pharyngitis.

In 268 children examined in New York, 63, or 24 per cent., had adenoid vegetations, associated with which were 32, or 50 per cent., of enlarged tonsils, and 29, or 46 per cent., of some anterior nasal obstruction. Hopkins (*Pacific Med. Jour.*, Sept., '92).

Objectively considered, the symptoms of post-nasal adenoid growths are most characteristic. The significant clinical signs are the dull, heavy, and stupid facial expression of the patient, the pinched nose or indrawn alæ, the depressed inner canthi, the elevated eyebrow, the corrugated skin of the forehead; the distorted or deformed thorax, or what is called "pigeon-breast"; the apparent mental deficiency, the decidedly affected speech, the impaired or retarded general physical development of the patient, etc.

Voluminous adenoids are commonly found in cases of scoliosis, and it is likely they are related as cause and effect, especially as removal of them early suffices of itself to bring about cure of the condition. In the most serious cases removal of the adenoids should precede orthopædic measures where the latter are necessary to supplement the former. The deformity known as hour-glass thorax is due to trophic disturbances from microbe-infections gaining access by way of the adenoids. Finally, the coincidence of certain forms of tuberculosis with adenoids regarded as due to the germs gaining access through the adenoids. Their early removal would obviate such infection. Bilhaut (*Bull. Méd.*, June 26, '98).

Adenoids as an etiological factor in orthopædic deformities. Granted that adenoids have some connection with orthopædic deformities, what can that connection be? 1. Both adenoids and deformities might be an expression of degeneracy. 2. Deformities might occur as a direct result of mechanical obstruction to breathing. 3. Orthopædic deformities occur in tubercular joint disease, which may have had their source of infection either directly or indirectly from adenoid vegetations. 4. Deformity may result directly from reflex irritation of the neighboring nerves by adenoid growths. 5. Lastly, and most important, adenoids may cause such a lowering of the general nervous vitality that they may be considered almost the direct cause of some of the atypical orthopædic deformities whose etiology is unknown. F. S. Coolidge (*Medicine*, July, '98).

Anæsthesia of the soft palate and the pharynx is sometimes a noticeable feature of mouth-breathers. Such patients usually are easily managed and offer but slight resistance when operating on the throat or naso-pharynx. Cleft-palate patients usually have hyperplasia of the lymphoid tissue at the vault.

The velum palati sometimes suffers markedly. It sometimes becomes thickened as a result of follicular glandular swelling or from œdema, occasioned by constant mouth-breathing and local irritation of the parts. When such a state of the palate prevails, free movements of the organ are impeded and the voice assumes a weak, dull, monotonous tone which may continue to be present even after the naso-pharynx has been freed. In fact, paresis of the palate is thus produced, dependent evidently upon the chronic congestion of the palatine glands and muscular tissue. Inflammation of the lymphatic glands in the neck is sometimes witnessed.

On examination of the throat and naso-pharynx the mucous membrane of the fauces may be found swelled, the uvula

drawn to one side, and the faucial tonsils diseased. The naso-pharyngeal cavity may contain a greenish mucus, tough and difficult to remove, which at the same time may run down the posterior wall of the pharynx. Sometimes the secretion remains confined and becomes offensive owing to decomposition. In adults post-nasal accumulations are apt to take place and become dry during the night, which in the morning creates nausea and hawking.

Nutrition of the patient is almost always more or less disturbed. The child becomes anæmic. The percentage of hæmoglobin is materially reduced, sometimes to 35 per cent. The red cells diminish very much in number.

That infectious diseases, such as scarlet fever and diphtheria, become more virulent and dangerous when post-nasal lymphoid tissue exists is not to be doubted. Adenoid tissue seems to furnish an inviting soil for the development of bacterial life, and it is also endowed with the power of absorbing infectious matter.

Diagnosis.—The diagnosis is quite easy when the general aspect of the patient is taken into consideration. The clinical picture of adenoid vegetations in the majority of cases is significant.

Conditions which may simulate adenoid diseases by causing mouth-breathing are any obstruction in the upper air-passages above the uvula; deviations, spurs, and ridges of the septum; weakness and falling of the alæ; catarrhal secretion which children neglect to blow out, and which adheres to, and stops up, the nose; chronic eczema of the anterior nares, with formation of crusts, which block the nostrils. It is not very common to find the openings of the nostrils too small. The specific snuffles of infants may simulate adenoid disease. John A. Farlow (Boston Med. and Surg. Jour., Apr. 21, '98).

The rhinoscopic mirror should invariably be used, and, if its employment be-

comes impracticable, resort should be had to the digital method of examination, which is perfectly safe and easy, no previous preparation being required.

Digital exploration of the cavity gives the surgeon an idea as to the situation, size, and extent of the growths and how much of the retronasal space is involved in the morbid process. Information is also obtained regarding the consistence of the vegetations: *i.e.*, whether they are soft and friable or firm and fibrous. Sometimes more or less hæmorrhage is induced by the examination. Certain precautions should always be observed: The finger must be rendered absolutely aseptic; this is readily done by the use of soap and water and immersion in absolute alcohol and then in carbolized oil. In order to obviate injury to the finger by the teeth of the patient a metallic guard can be used, or, what is better still and more convenient, a piece of sterilized gauze wrapped sufficiently thick around the finger. The mouth-gag is preferred by some operators. The patient should be held and the head properly supported by an assistant.

Routine employment of palpation of the naso-pharynx recommended as superior, in many ways, to posterior rhinoscopy. The necessary relaxation of the palate is secured by the pronunciation of the French "on." Ziem (Ther. Monats., Dec., '92).

If the patient is sufficiently old, a 2- or 5-per-cent. solution of cocaine, sprayed or brushed over the throat, may be used to diminish irritability. Frequently enlarged faucial tonsils are present which prevent a good view of the naso-pharynx. When this is the case the tonsils should be excised before proceeding further.

Occasionally the space between the soft palate and the posterior wall of the pharynx is so small that illumination of the cavity above becomes impossible.

Then, again, in rare instances post-nasal inspection with the mirror is facilitated by retracting the palate with a proper instrument. Yet, generally speaking, children do not tolerate such a procedure. The parts to be examined with the rhinoscopic mirror are the upper margin of the posterior nares or the choanæ, the vault and posterior wall of the post-nasal space. Chiefly concerned in the production of the affection are the upper part of the posterior wall and the highest point of the roof. Sometimes, however, the growth occupies a position far forward in the naso-pharynx, encroaching upon the turbinal structures.

Rosenmüller's fossæ and the spaces between the Eustachian cushions and the roof of the pharynx are sometimes the seats of the vegetations. Indeed, adenoid growths in Rosenmüller's fossæ exercise a greater interfering influence over the Eustachian patency than can be imagined. Unilateral deafness may be traced to this (Gibson). One of the most frequent forms of the disease to be seen by direct inspection is a cushion-shaped body generally situated in the median line of the vault, sometimes extending anteriorly toward the choanæ or posteriorly over the upper half of the pharyngeal wall. The free surface of this tumor may be smooth or corrugated. Its color, when the growth is not acutely congested, usually is a pale pink. Yet it may be intensely red.

The next variety are lobulated masses separated by a central depression that sometimes makes it appear as if two distinct tumors were present, yet which, after removal *en masse*, are found to have a common base.

Not infrequently a number of these separate growths are closely packed together and suggest the existence of but one mass. Then, again, the mucous

membrane of the entire vault or of parts of the post-pharyngeal wall are studded with numerous adenoid excrescences.

The surface is never granular, though sometimes coarsely lobulated; no vessels are visible on the surface, as frequently happens with retronasal polypi. In adults, where the growths have undergone partial atrophy, they may appear as distinct excrescences studding the posterior wall, the vault, and even the lips of the Eustachian tube.

From fibrous tumors the following points serve to distinguish adenoids, viz.: (1) on rhinoscopic examination the latter are not sharply defined; (2) on palpation they feel soft. Malignant tumors in this situation are not common in any class of patients, and least so in children; they are usually associated, when soft, with frequent and violent hæmorrhages, while other grave symptoms speedily ensue. In children who show evidence of an inherited taint the possibility of adenoids should be borne in mind. P. McBride and A. Logan Turner (Edinburgh Med. Jour., May, '98).

Occasionally bridges of tissue extend from the adenoid growths to the posterior lip of the Eustachian tube.

This condition is invariably a source of aural disturbance. The band of tissue seems to be of the same nature as that of the lymphoid growth. In adults, in whom the post-nasal growth has almost wholly disappeared as a result of atrophic process, Rosenmüller's fossæ still seems to be occupied by adenoid tissue.

Etiology. — Adenoid vegetations are common and especially peculiar to childhood. They pre-eminently characterize early life and sometimes affect several members of one family at the same time.

Sajous states that heredity is an important etiological factor in many cases, and that in this country adenoid growths seem to be oftener prevalent among females than males.

In 2000 patients, 858, or 42.9 per cent., were the subjects of disease of the tonsils (faucial, pharyngeal, and lingual), and thereby induced to seek relief from the symptoms for which they were in all cases partially, and in many instances wholly, responsible. Enlargement of these tissues is somewhat more common in the female sex. In hypertrophy of the lymphoid material at the base of the tongue the female shows a very decided preponderance over the males. Up to the fifteenth year the males suffering from adenoids are slightly more numerous than females (238 to 209); after this period, however, the proportions are directly reversed, and continue so. In hypertrophy of the tonsils alone the proportions up to the fifteenth year are practically the same; afterward the number of females is more than double that of males. Of the 2000 patients, 1123 were females and 887 males. In 2000 observations the following percentages were found:—

Of adenoids alone.....	18.40
Of adenoids and tonsils.....	16.65
	—
	35.05
Of tonsils alone.....	5.05
Of hypertrophy of the lingual gland	2.80
	—
	42.90

H. Arrowsmith (N. Y. Med. Jour., Aug. 28, '97).

The abundance of lymph-follicles in the retronasal space of children affords an explanation for the frequent appearance of the disorder in early life. The disease may be present at birth or it may commence during the first or second year.

Between three and fifteen years seems to be the period of life in which the disease is most common. Yet, as a general rule, the third year is the time when evidences of post-nasal adenoid hypertrophy become manifest. Adult life is by no means exempt from the trouble, for it is not an unusual thing to see persons whose ages range from eighteen to

thirty-five years, or even more, suffer from the disorder.

Six cases in nurslings under six months old, one of these being but one month of age. Huber (Archives of Ped., Jan., '94).

As the total result of examination of 500 cases of adenoids the conclusion reached that adenoids are most commonly met with between 6 and 15, but that they are fairly common under 5 years and between the ages of 15 and 20. Sex seems to exercise a very small influence, the figures being 263 males and 237 females. Heredity has a very considerable influence. Out of the 500 cases there were thirty patients who had either one or more brothers or sisters affected in the same way; in nine instances there were two only, and in four there were three members of the same family affected. Damp atmosphere favors the occurrence of symptoms in those who have hypertrophied pharyngeal tonsils, while opposite conditions tend to diminish the nasal obstruction when it exists. Among deaf-mutes it has been shown that adenoids are much more frequent than among other children. P. McBride and A. Logan Turner (Edinburgh Med. Jour., Apr., '97).

Lymphoid tissue in childhood is very easily excited into active growth, the faucial tonsils and cervical glands taking on active inflammation under trifling influences. Chronic hypertrophy is chiefly brought on by repeated or continued inflammations of the tissue.

The amount of tissue sufficient to produce marked symptoms of hypertrophy in children does not cause similar conditions in adults, because as adult life is approached the naso-pharyngeal cavity increases its dimensions, thus overcoming by degrees the amount of obstruction. Not infrequently only remnants of the disease in the form of irregular thickenings of the mucous membrane are found in adult age, which predisposes to acute exacerbations of post-nasal catarrh. The predisposition of adenoid growths as the

individual grows older is to atrophy and disappear spontaneously.

The researches of Meyer have demonstrated that adenoid vegetations occur in all climates and affect people of all nations. A damp, cold climate seems to favor more especially their production.

The rheumatic or strumous diathesis seems to predispose to their development. Acute catarrh of the nose and nasopharynx, such as is often induced by acute coryza, is unquestionably accountable for the excessive development of the tissue in many instances. Undue development may also be produced by septic disturbances of the lymphoid tissue. This accounts for their appearance as a sequel to exanthematous diseases after scarlet fever, measles, whooping-cough, etc., when the cause of the hypertrophy is traceable to the action of a pathogenic organism. The tubercle bacillus may find a soil in the hypertrophied tissues.

From examination of 213 cases of adenoid vegetations, the conclusion reached that there is no bactericidal property in the secretion of the glands, and probably none in the nasal mucus. Latent lacunar encysted adenoiditis is a rarity. As regards the bacilli, 25 examinations disclosed none; 37 streptococci, but never pure; 60 staphylococci, pure, and 69 associated with other micro-organisms; other forms of cocci, 41 pure and 54 associated; pneumococci, 3; leptothrix buccalis, 1 pure and 1 associated; and a short bacillus not taking Gram's stain in 1 case. There was hypertrophy of the tonsils in 17 cases; tuberculosis, collateral in 30, hereditary in 18, and personal in 17, but Koch's bacillus was never detected in the vegetations. Gourc (Thèse de Paris, No. 175, '97).

While adenoids consist essentially of hyperplastic pharyngeal lymphoid tissue, the epithelium and fibrous-tissue changes are inconstant, variable, and independent of the age of the patient. The new-formed fibrous tissue is largely perivascular in distribution. It may occasionally be one of the factors in the process

of disappearance of the adenoid. The hyperplastic pharyngeal tonsil often contains micro-organisms, and these are mainly pyococcic forms. The bacteria for the most part lie near the surface; and the infection usually occurs from the surface, with or without demonstrable lesion of the epithelium. Primary tuberculosis of adenoids is probably more common than most previous studies show. Sixteen per cent. of the writer's series contained tubercle bacilli, 10 per cent. with characteristic lesions of tuberculosis. The tubercle bacilli were present in small numbers. The lesions in primary tuberculosis of the adenoid are generally close to the epithelial surface and focal in character. Occasionally they may be found in the deeper parts of the pharyngeal lymphoid tissue. The pharyngeal tonsil may be a portal of entry for the tubercle bacillus and other micro-organisms in localized or general infections. A. J. Lartigau and Matthias Nicoll, Jr. (Amer. Jour. Med. Sciences, June, 1902).

Two facts are beyond dispute: The peculiar susceptibility in childhood to infectious diseases, and the mode of invasion by the upper respiratory tract. As corollary to these, the following conclusions are submitted: The pharyngeal tonsil possesses a distinct function or functions. This function is of the nature of a defense against the entrance of bacteria and consists in a certain irrigation of the tonsil surface by a lymph stream loaded with lymphocytes. This protection function carries with it the inherent qualities of the tonsil to enlarge on the slightest irritation for the affording of further power of defense. This inherent tendency of the tonsil to enlarge is further seen in the frequent recurrence of the tonsil after removal. Strictly speaking, then, in the great majority of cases such enlargements are not a pathologic, but a physiologic process. Harris (American Medicine, Jan. 2, 1904).

Influenza is often responsible for post-nasal adenoid hypertrophy. The growth sometimes, as a result of congestion and inflammatory infiltration, becomes enor-

mously enlarged, sufficiently so as to occupy the whole naso-pharyngeal vault, totally obstruct the posterior nares, and cover to a greater or less degree the orifices of the Eustachian tubes.

Occasionally, in cases where the adenoid growth involves the lateral and posterior walls of the naso-pharynx, the enlarged lymphoid mass may be present below the velum palati or become quite visible whenever the mouth of the patient is widely opened.

Pathology.—Post-nasal adenoid growths undergoing hypertrophic changes resemble in structure the tonsils of the fauces when similarly affected. Microscopically examined they are found to consist of a retiform net-work of connective tissue filled with lymph-corpuscles. The growths are richly supplied with blood-vessels and are covered with a layer of ciliated epithelium, resembling more or less the mucous membrane from which they take their origin. Adenoid vegetations assume various appearances. Frequently they project anteriorly as excrescences or small bodies or clusters of vegetations, distributed over the vault or the posterior wall of the pharynx. Sometimes they hang from the roof in the form of elongated or stalactite-like masses, veiling at the same time the posterior nares or the mouths of the Eustachian tubes. Then, again, but one cushion-like mass, whose surface is corrugated, pale, red, or purple, may be found.

This form is common. The vegetations when soft are quite friable and easily removed, while, on the other hand, when firm in texture their attachment is strong and removed with more or less difficulty.

Chronic hypertrophic rhinitis, chronic follicular pharyngitis, or chronic enlargement of the faucial tonsils is very often

intimately associated with post-nasal adenoid hypertrophy. The aural complications are due to an exudative inflammation or abscess of the middle ear.

As has been mentioned, the tendency to atrophy and disappear spontaneously is the history with puberty. This change probably is favored by the action of mechanical processes. During this period the fibrous structure of the tumor also changes, thus causing ultimate obliteration of the blood-vessels and lymph-ducts in consequence of pressure and constriction of these vessels. The quantity of blood-supply becoming lessened, the lymph-cells gradually diminish in number and glandular atrophy results.

Teachings of embryology suggest that pharyngeal structures are related intimately to encephalic structures by means of the pituitary and pineal bodies; and pathology has already associated morbid states of the pituitary body with general nutritive processes. Adenoid growths, while, as a rule, acting mechanically, will occasionally manifest the symptoms of a veritable disease which is allied to other affections of the blood-vessel, gland, and lymph systems, and which should be regarded as having a dominating influence on metabolic processes. It is thus placed in alliance with acromegaly and myxœdema. Harrison Allen (*Med. News*, June 22, '95).

Histological examination showing: 1. That the ciliated epithelium may be converted into the stratified squamous variety, and the latter become much thickened, as the result of the intermittent pressure to which the hypertrophy is subject. 2. That this change tends to occur in the smaller naso-pharynx of the young child. 3. That the cilia may become destroyed over large areas, and the epithelium thinned to a varying degree; and, further, that migration of leucocytes is not general. 4. That there is a tendency to an overgrowth of fibrous tissue, which commences in and around the blood-vessels, and, gradually invading the lymphoid tissue, leads to shrinking of the growth. 5. That this process is

not confined to the period at or after puberty, but occurs also in very young children, and is, therefore, independent of the age of the patient. P. McBride and A. Logan Turner (Edinburgh Med. Jour., Apr., '97).

Whether operated upon or not, the retrogression of the lymphoid material, while frequently leaving the surface smooth, usually leaves behind in the stroma a superabundance of fibrous tissue, and possibly some epithelial metaplasia of the surface, which are liable to interfere with the proper functions of the vascular and glandular organs of the pharynx—resulting in post-nasal catarrh. Another form of cicatricial sequel of adenoids is Tornwaldt's disease, resulting from the inflammatory agglutination of the surfaces of the lymphoid folds of the pharyngeal tonsil one to the other, leaving closed cavities erroneously called cysts. Jonathan Wright (Brooklyn Med. Jour., July, 1900).

Prognosis.—The prognosis of post-nasal adenoid growths from the standpoint of treatment is, in the majority, of cases satisfactory. But, when the disease is allowed to remain unrelieved and pursue a natural course, the consequences incident to these growths are sometimes so far-reaching that they cannot be repaired either by Nature's process or the physician's aid.

Very much depends upon the age of the patient. If the disorder is recognized in early life or at the time when the symptoms are most pronounced and before local or systemic complications set in, operative interference arrests the course and duration of the malady. In a given case of a child or youth suffering from adenoid vegetations it is almost always safe to advise parents in the following manner: 1. That complete removal of the growth restores nasal respiration. 2. That the tendency to take colds in the head, accompanied by sore throat or bronchial cough, will be lessened. 3. That reflex conditions will disappear. 4.

That snoring will diminish. 5. That mental and physical vigor will become increased. 6. That chest-deformity will usually subside. 7. That impaired hearing will be remedied. 8. That restlessness during sleep will become modified. 9. That general malnutrition and anæmia will become improved.

On the other hand, in adults where serious ear disturbances—such as chronic otorrhœa, deafness, tinnitus aurium—are the result of long-continued post-nasal stenosis, a guarded prognosis must be given.

In cases of epilepsy or asthma directly traceable to the presence of naso-pharyngeal adenoid growths it always is the part of wisdom to promise but little from treatment, though one is forced to entertain the belief that nasal obstruction is, in a great measure, connected with the origin of the paroxysm.

Treatment.—Cases are occasionally met with that do not present the usual clinical aspects of the malady. They show but slight embarrassment to nasal breathing during attacks of coryza, a proneness toward sore throat and some enlargement of the faucial tonsils, and a moderate manifestation of nervous involvement. Further than these evidences perhaps nothing more is present indicating the existence of the affection.

An immediate operation in these mild forms should not, as a rule, be insisted upon if opposition is offered by parents and friends. The patient should be kept under observation, the behavior of the growths and the effect catarrhal conditions of the naso-pharyngeal cavity have upon them being closely watched. Change of climate or of environment often has a salutary effect; complications are thus warded off. Should it, however, be ascertained that the vegetations have a tendency to develop, threatening ob-

struction, and affect the mucosa of the neighboring organs, radical removal is indicated. Under practically all circumstances, however, early and complete removal of the growths is rational and absolutely justifiable when it is remembered that topical and internal applications of remedies have little or no effect.

The contra-indications to removal of adenoid vegetations are hæmophilia, anomalies of the arteries in the naso-pharynx, and during family epidemics of whooping-cough, measles, or influenza, and cases in which an acute or subacute catarrhal condition of the respiratory passages is present. M. Helm (*Soc. Française d'Otol., de Laryn., et de Rhin.; Univ. Med. Jour.*, June, '96).

Of 2019 cases of adenoid growths treated in La Clinique des Enfants Malades, 1214 were of the respiratory type, 75 of the auricular type, and 730 of mixed form. Prophylactic treatment should be instituted in those cases which present predisposition to lymphatic enlargements, and it should consist of general tonics and local antisepsis, among the latter being instillations of oil and insufflations of medicated powders. Mentholated oil (1 to 50) is preferred, but, in cases where this is not well tolerated, a combination of sterilized olive-oil with resorcin (1 part to 25 of the oil) is of value. The instillation should be made two or three times a day. Borated vaselin or mentholated vaselin may be used instead. An excellent powder consists of menthol, 10 centigrammes ($1\frac{1}{2}$ grains); boric acid and talc, of each, 5 grammes ($1\frac{1}{4}$ drachms). The nasal irrigation may be prescribed with the above treatment, but the possibility of damage by this method is noted. It is necessary to have the canal freely open and use but slight force in the douching. In using the douche the quantity should not be more than 20 cubic centimetres (5 fluidrachms); the fluid, preferably a boric acid solution. When the adenoids are actually present, medical treatment should consist of an application of iodine with glycerin, 1 to 50; but this is merely palliative, and

surgical measures are the only means to effect a cure. Cuvillier (*Annales de Méd. et Chir. Infantiles*, Jan. 1, 1901).

Certain constitutional conditions sometimes exist indicating the use of cod-liver-oil or some other form of the so-called reconstructives. The tuberculous or scrofulous diathesis is the condition chiefly requiring such assistance. After the occlusion of the naso-pharynx has been overcome these cases seldom require internal medication, as the improved respiration soon revives the powers of nutrition and gives renewed vigor to the individual.

Chemical caustics and the electrocautery came into vogue soon after Meyer and Löwenberg recommended a purely surgical procedure. If for no other reason than the mere fact that the use of these destructive agents excite an undue and sometimes unmanageable septic reactionary effect, involving the Eustachian and tympanic structures, they should be discarded. Their employment is inefficient and dangerous.

Three cases in which there was rapid disappearance of adenoid vegetations. The first occurred as the result of a sharp attack of influenza; a month later an examination revealed that there were no longer adenoids. The second case was similar. In the third case an attack of influenza was also followed by the complete disappearance of the adenoids. Nothing indicated the occurrence of local inflammation. It is therefore advisable before operating after an infectious fever to re-examine the naso-pharynx. Chauveau (*France Méd.*, Sept. 1, '99).

The operative method is universally employed at present. The instruments first devised for post-nasal adenoid operations were the ring-knife of Meyer and the cutting-forceps of Löwenberg; the latter of which, or modifications of it, are still used by many operators. Unscientific and septic as the method may seem, the sharp forefinger-nail used as a

curette, at one time quite popular, still holds a position of usefulness in the performance of these operations. But its sphere is limited and the method cannot be relied upon for thoroughness because experience teaches that recurrence of the symptoms, in the majority of instances, is very apt to occur. Repetition of the procedure is also often necessary. It is only in those cases where the vegetations are soft and not very abundant that the finger-nail operation proves satisfactory. Its utility lies principally in the means it affords in clearing away shreds of tissue that remain after the employment of the forceps or the curette. Adenoid tissue, for example, occupying Rosenmüller's fossæ, recesses into which cutting or scraping instruments cannot satisfactorily be carried, can always be removed in this way. Sometimes after curettement fringes of vegetations veiling the posterior nares and hanging, as it were, from the upper margin of the choanæ, remain and still cause obstruction or furnish a point for redevelopment of the growth. These shreds can be more conveniently got rid of with the finger-nail than by any other means. The nail must be made sharp and aseptic. Before passing the finger into the naso-pharynx it should be immersed in absolute alcohol for a few minutes, which hardens the nail and also aids in freeing it of bacteria. An artificial finger-nail constructed of steel and fitted to the finger is recommended by some operators. The method is not practical nor satisfactory.

The form of instrument most frequently used is Gottstein's curette. Many modifications of this instrument have appeared from time to time. The curve of the blade and of the shank seems to especially adapt the instrument to the anatomical disposition of the parts over which it must be passed.

Every practical operator will not be content with the possession of one form only; he will have at hand different sizes with various shapes so as to enable him to make a selection suited to the case in hand. Useful as the Gottstein curette is, still it must not be forgotten that its application is not unattended with danger, especially in the hands of the inexperienced operator.

The intent of the curette is to lift *en masse* the lymphoid tissue from its attachment by a clean, free cut. Gottstein's curette is a cutting, not a scraping, instrument. On no occasion should it be introduced into the naso-pharyngeal cavity in a dull state. Otherwise the tissues may become mutilated and a grave injury to neighboring organs or mucous membrane result. An accident



Blade of the Gottstein curette.

known to have taken place is the detachment, or stripping-off, of the mucous membrane of the pharynx.

In drawing the curette backward and downward the instrument must be held firmly and guided so as to sweep the curve unimpeded.

Case in the practice of each of the writers in which the cutting portion of a Gottstein curette broke as pressure was made in the initial step of the operative procedure. In Dr. Holmes's case, operated upon under general anæsthesia, the fragment was extracted by pressing his finger upon one end of the broken blade, so that it became imbedded in his flesh, enabling him to withdraw it into the mouth, whence it was removed with forceps. In Dr. Garlick's case, operated upon without anæsthesia, the fragment was swallowed and passed three days later. C. R. Holmes and H. S. Garlick (Laryngoscope, May, 1901).

In order to obviate interference with adjacent structures only sufficient pressure and force must be exerted as will excise the growth and nothing more. The cutting edge of the curette must never be carried downward on a direct line with the posterior wall of the pharynx; it must be caused to follow the course of the circle described by the naso-pharyngeal curve, the concavity of the blade at the completion of the operation presenting underneath the palatine arch, with the uvula appearing in the fenestrum of the instrument.

If the operation is done in the manner indicated the existent collateral vegetations, as those in the fossæ of Rosenmüller or along the lateral walls of the naso-pharynx, which were not brought within the grasp of the curette, can be taken away with the finger-nail, the operation being performed under the influence of a general anæsthetic. When without anæsthesia, the naso-pharynx previously having been illuminated, then Hooper's post-nasal cutting forceps can be used.

Preferred treatment of adenoids almost always: removal by cold wire-snare introduced through the nose and controlled by means of posterior rhinoscopy. Through the nose the nares are cocaineized before operation. Bleeding is slight; pain is absent or insignificant. Of 163 private cases operated on solely by the snare, 66 were cured in one sitting, 56 in two, 33 in three, 7 in four or five, and 1 in nine. This procedure is absolutely free from danger, causes slight bleeding, is followed by no reaction, is free from pain, and can be applied under cocaine anæsthesia. Chiari (Wiener klin. Woch., June 7, '94).

New method by which the naso-pharynx can be exposed to direct examination: The patient reclines on a couch with the head well thrown back; the operator then takes hold of the tongue and instructs the person under examina-

tion to breathe quietly, while he introduces a hook with which the soft palate is drawn forward, at first very gently and afterward more energetically. The operator is then able to perceive the whole surface of the naso-pharynx. It is possible by employing this method (1) to operate directly, without using a mirror, on naso-pharyngeal tumors, and (2) to catheterize the Eustachian tube by the aid of direct vision. Katzenstein (Archiv für Laryn., Jan., Feb., '97).

Complications accompanying the "cutting away" of adenoid tumors are: tearing away of mucous membrane of the pharynx; removal of the basilar apophysis (Castex); death from hæmorrhage (Delavan and Schmiegelow); dropping of tumor into the laryngeal cavity and causing suffocation. Instances have been reported where teeth have been broken by improper manipulation of the curette and where the cutting-blade itself was broken and pieces swallowed by the patient (Castex). Convulsions also have been reported as a complication of the operation. It not infrequently happens that the ablated growth is swallowed by the patient after the use of Gottstein's curette. To obviate this occurrence a device was added to the instrument by Delstanche by means of which the growth is held within the fenestrum, thus preventing its dropping into the throat. Considerable bleeding usually takes place immediately after curettement, but this seldom requires special attention.

Series of 1000 cases of adenoid growths of the pharynx operated upon by author. Growths removed with Gottstein's ring-knife. In no case was there severe bleeding. Max Schaffer (Deutsche med. Woch., July 16, '91).

Death from convulsions after removal of adenoids in a nervous and anæmic boy, whose naso-pharynx was scraped under a 10-per-cent. cocaine solution. Sanford (La Sem. Méd., vol. ii, No. 29, '94).

The immediate dangers in operating for adenoids are (1) of entrance of blood and the formation of a clot in the larynx, thus asphyxiating the patient, and (2) of damage to the Eustachian tubes and the setting up of an otitis. To avoid the first, operators are content with the precaution to keep the head lower than rest of the body, and the face downward. Where this has been done no report of fatalities recalled. J. E. Brown (*Columbus Med. Jour.*, Nov. 9, '97).

Case of fatal hæmorrhage from the removal of adenoid vegetations occurring in the practice of a surgeon who had often done the operation without mishap. The patient, a boy, 12 years old, showed nothing strikingly abnormal beyond a pronounced adenoid habitus and scrofulous glands in the neck. Operation was done without anæsthesia, and the ordinary Gottstein annular knife used. Without any warning, a sudden gush of arterial blood issued from the mouth and nose. In spite of prompt tamponing and subcutaneous and intravenous saline injections, death occurred in a few minutes. The internal carotid artery was found to have been opened just in front of its point of entrance into the carotid canal of the pars petrosa ossis temporis. Swollen glands had probably pushed the vessel forward, so that the pressure of the knife caused its rupture, for it was not cut. Schmiegelow (*Monats. f. Ohrenh.*, No. 3, '97).

Case of fatal secondary hæmorrhage on the eighth day following the removal of adenoid vegetations. Patient, who was eleven years old, gave no history of a bleeder, but it was noticed the blood from the first bleeding was only partly clotted. Wallace Preble (*Boston Med. and Surg. Jour.*, May 19, '98).

Three cases of hæmorrhage following adenoid operations. Personal operating experience on these growths of seven years before a complete realization of what dangerous consequences could ensue. Surgical procedure in these cases. The adenoids were removed with the Gottstein knife under cocaine anæsthesia. Martin (*Laryngoscope*, July, '99).

Case in which a pharyngeal tonsil the size of a walnut was removed from the

pharynx of a boy 10 years of age. Severe hæmorrhage occurred a few hours later, and the patient died four days after the operation despite all that could be done. The patient was hæmophilic. Richard Sachs (*Jour. of Laryn.*, etc., Feb., 1900).

An instrument devised to take the place of the curette, a post-nasal guillotine, has been devised by the writer. It is constructed in such a manner as to accomplish all that is claimed for the curette without causing injury to the organs adjacent to the adenoid tumor requiring removal. Another advantage claimed for it is simplicity of technique. In introducing the guillotine into the naso-pharyngeal space no difficulty is experienced, the curved blade being carried into the vault in the same manner as the curette. By keeping the instrument in the median line of the roof and exercising such pressure as will force the blade upward and forward the tumor is brought within its grasp and readily excised by drawing from before backward the guarded knife.

The question arises: will hæmorrhage follow an operation with the guillotine more readily than when the cutting forceps or the curette is employed? Experience teaches that it does not. In hæmophiliacs hæmorrhage is always liable to occur regardless of the method employed; simple palpation of the adenoid tissue has been followed by fatal bleeding (Delavan). Secondary hæmorrhages of a violent nature have taken place after the removal of the post-nasal adenoid growths.

[Two cases of this character are recalled in boys, respectively, 8 and 9 years of age. Apart from the adenoid disease they were apparently well. One week after the operation (by Gottstein's curette) persistent bleeding set in, which could only be brought under control by forcibly tamponing the post-nasal space. Hinkle reports a case of hæmorrhage of an alarming character controlled

apparently by applying to the bleeding surface the gummy substance formed by the combination of antifebrin and tannic acid in solution. JACOB E. SCHADLE.]

Is recurrence liable to take place after the removal of adenoids? Not as a rule, provided the operation has been skillfully done and complete removal accomplished.

Recurrence of adenoid vegetations after their removal is more frequent than is usually supposed; thus necessity of complete removal. F. E. Hopkins (N. Y. Med. Jour., Jan. 26, '95).

The recurrence of the growths in young children sometimes witnessed is due to the greater difficulty in effecting complete removal in them and the greater predisposition to the proliferation of lymphoid tissue under slight provocation. Dundas Grant (Jour. of Laryng., Aug., '97).

When at all possible it is better to remove adenoid growths without the use of a general anæsthetic, as there can be no doubt that anæsthesia adds an element of risk to the operation. Locally applied, cocaine is invaluable; it renders the presence of instruments tolerable and the operation quite easy, especially if the palate can be retracted with either hook or tape. But the dexterous operator generally requires no auxiliary assistance (palate-retraction or naso-pharyngeal illumination), and contents himself with sunlight directed into the throat, and perhaps of the index finger to guide the instrument into the naso-pharynx.

When a general anæsthetic is used the patient should be placed in bed or on a couch with the head on a level with the body, which position should be maintained—after the patient has been raised or turned to expel the blood from the naso-pharynx—until the immediate effects of the anæsthetic have passed off. Sometimes retching and vomiting of blood that was swallowed occur after the operation.

The after-treatment is simple. The patient should be kept in-doors for a period of a week and the nose occasionally sprayed with a warm alkaline solution. If reactionary symptoms appear, they should be met in accordance with their nature and severity. If confident that the adenoid vegetations have been thoroughly removed, the nose and pharynx, etc., should be examined for enlarged tonsils, spurs, deflection of the septum, and chronic hypertrophies of the mucous membrane. If one or more of these conditions are found to exist, the trouble should be corrected, to avoid encouragement of recurrence of lymphoid hypertrophy.

Acute Naso-pharyngitis.

Symptoms.—In the first stage of this affection a more or less marked sense of dryness in the parts, and, perhaps, possibly some difficulty in swallowing, is experienced. In the course of a day or two a mucous discharge appears which at first is thin and gradually becomes thicker and more purulent.

The annoying symptom which early establishes itself is the dropping of secretions into the throat, causing a constant desire to hawk and expectorate. As the disease progresses the voice in not a few instances becomes altered. Hoarseness or "raspiness" is complained of. If the Eustachian tubes are implicated in the morbid process, tinnitus, impaired vocal resonance, darting pains along the Eustachian tract, etc., are also complained of.

Symptoms of acute rhinitis or pharyngitis may also appear when acute catarrhal inflammation of the naso-pharynx coincidentally exists with one or both of these diseases.

The course of the disease is variable. Sometimes the mucous secretion ceases in a few days, and the mucous membrane

returns to the normal, while again, notably in debilitated persons, the malady lingers on for weeks or months, eventually assuming a subacute or chronic character.

Among the complications to be encountered is involvement of the Eustachian tube and of the middle ear. Sometimes the orifices of the tube are found red and swelled and covered with secretions; a feeling of fullness and bubbling in the ear is produced upon blowing the nose. Sero-mucous and purulent middle-ear inflammation may follow such a condition.

Etiology.—Acute naso-pharyngitis is sometimes produced by an extension of inflammation from the nasal passages or from the pharynx. The various causes inducing acute inflammation of the mucous membrane of the nose—such as inhalation of dust, climatic changes, eruptive fevers, exhaustive diseases, etc.—also play an important etiological rôle.

Among the local causes chiefly to be mentioned is the presence of adenoid or lymphoid overgrowths. That such a condition forms a predisposing cause of the attacks cannot be questioned; this is particularly during childhood and youth, the periods when acute naso-pharyngitis is most common. Acute inflammation of the naso-pharynx then frequently gives rise to purulent rhinitis or inflammatory disturbances of the fauces.

Pathology.—The existence of such a disorder as acute idiopathic catarrhal inflammation of the naso-pharynx is not accepted by all observers. That it does can be substantiated by clinical evidence. This is especially true when the sympathetic system becomes influenced through some factor tending reflexly to dilatation and engorgement of the blood-vessels. It is due, in the majority

of cases, according to Sajous, to extension of neighboring disorders through contiguity of tissue.

Prognosis.—Of utmost importance is the early recognition and treatment of this affection. If the disease is neglected and allowed to run on unattended, it is destined, in the majority of cases, to resolve into a chronic catarrhal disorder: a persistent and troublesome malady.

Treatment.—In the early stage, when pain and dryness of the parts are present accompanied by general malaise and a febrile movement, considerable can be accomplished toward alleviating suffering and aborting the disease by the administration of small doses of apomorphine ($\frac{1}{16}$ grain) frequently repeated. Should there be any hepatic torpidity or digestive disturbances, a mercurial, followed in four or six hours by a saline purgative, should at once be administered.

Warm alkaline lotions, applied in the form of a spray to the nasal passages or post-nasal spray, prove grateful and beneficial. A solution of cocaine (4 per cent.) applied in the same manner affords immediate comfort and aids in controlling vascular engorgement. After the disease has passed the stage of acute hyperæmia, and muco-purulent secretions appear, astringents or alteratives are indicated. Sulphate or sulphocarbonate of zinc and silver nitrate applied with a pledget of absorbent cotton, at intervals of twenty-four or forty-eight hours in solution of the strength of 2 per cent. or 4 per cent., are especially valuable. Before employing silver solutions the larynx should be cocainized to avoid the laryngeal spasm that would follow the dropping of some of the solution into the cavity.

An aqueous solution of suprarenal-capsule extract (10 grains to 1 drachm

of saturated solution of boric acid) topically applied, has been found to be of considerable value in reducing the acute hyperæmia and inflammation of the parts.

Solution of ichthyol, $\frac{1}{2}$ of 1 per cent., applied by the patient himself every two hours, considered as very efficient in naso-pharyngeal catarrh. P. Meyjes (Geneesk. voor het Konin. der Nederlanden, Sept. 4, '92).

Turpentine with oil of anise makes a valuable application, especially in acute exacerbations of naso-pharyngitis. It may be diluted with lavender. This should be applied to the naso-pharynx with the cotton tuft on a curved applicator several times weekly. It is best to use the rhinoscopic mirror in every case in which applications are made to the naso-pharyngeal region. Somers (Memphis Lancet, July, '98).

Chronic Naso-pharyngitis (Chronic Post-nasal Catarrh).

Symptoms.—The subjective symptoms are mainly due to the accumulation in the naso-pharynx of a more or less purulent secretion, which causes coughing and hawking; while the local inflammatory disorder may cause dull headache; altered voice, taste, and smell; and temporary deafness due to the interference with the function of the Eustachian tube. The patient complains of a tendency to colds in the head, sudden losses of voice, temporary pains, and raw sensations in the throat. He frequently "hawks" masses of muco-pus more or less desiccated: a feature that gives him the greatest concern. The rhinoscope shows local hyperæmia; the naso-pharynx is more or less covered with pus or dried secretions, which, when removed, often leave bleeding surfaces. The vault of the naso-pharynx with its adenoid cushion is generally puffed out and discharges quite freely. Local dryness is sometimes observed.

There is often considerable elongation of the uvula, also an infiltration and

thickening of the pillars of the fauces. Laryngitis is a frequent complication, while other morbid conditions of reflex origin—such as chorea, reflex epilepsy, neuralgia, supra-orbital headache, gastric disturbances, uterine disorders, retarded development, and simple anæmia—may be induced.

When extending over a long time these cases often develop dry naso-pharyngitis. The main features of this condition, also termed "sclerotic post-nasal catarrh," are not unlike the same condition of the nasal fossæ (atrophic rhinitis); it may be and often is complicated with ozæna. It may occur as a sequel to catarrhal inflammation and be dry from the start.

Under these conditions the oro-pharynx appears dry and lustrous; and may be covered with scales of dark-colored dried mucus. When the stage of ozæna is reached, every few days round, oval, or cup-shaped masses of dried mucus are expelled, which vary some as to color and consistence. On cleansing, the mucous membrane looks pale and atrophied.

Etiology.—Childhood seems to be the most favorable time for this disease to appear. The gouty, syphilitic, scrofulous, and tuberculous diatheses seem to predispose to it, and under these circumstances it is very apt to become chronic or sub-acute. Incessant use of tobacco, cocaineism, alcoholism, diseased nasal passages, enlarged tonsils, chronic gastric disease are all undoubted etiological factors. Suppurative diseases of the ethmoidal and sphenoidal sinuses where the pus flows into the naso-pharynx evidently are a cause of chronic naso-pharyngitis. Chronic follicular tonsillitis and its cheesy, pus-producing deposits, and decaying and neglected teeth are also causative.

Cases of bilateral tubercular glands constitute over 70 per cent. of the cases personally observed, and, with the addi-

tion of some cases of unilateral disease, in over 80 per cent. the exciting cause of the enlargement was found in the naso-pharynx. There seems ground for the belief that of naso-pharyngeal catarrhs a number are in their nature tubercular. Nicoll (Glasgow Med. Jour., Jan., '96).

Pathology.—Chronic naso-pharyngitis may be divided pathologically into three varieties: the diffuse, hypertrophic, and sclerotic or atrophic. The diffuse form is present early in the disease, before the infiltration of cellular deposits has taken place; it is the transition period preceding the chronic disease. In the hypertrophic form there is infiltration of the cellular elements, this stage culminating in sclerosis,—the third form,—in which atrophy and loss of function occur.

Prognosis.—The disease is controllable by appropriate treatment if it is not of too-long standing. In the latter case, however, it is practically incurable. Pharyngitis sicca is a particularly obstinate affection.

Treatment.—If any constitutional condition exists, this must first be appropriately treated. Locally, cleanliness is the first essential and should be accomplished by some non-irritating alkaline, disinfectant solution, such as Seiler's or Dobell's. After the cavity has been cleansed, topical applications should be made to the post-nasal space as the condition indicates. When dry, stimulants and alteratives such as nitrate of silver, 20 grains to the ounce, and iodine pigment are to be applied. The following preparation is useful:—

R Iodine crystals, 6 to 10 grains.

Iodide of potassium, 12 to 20 grains.

Glycerin, 1 ounce.—M.

This should be followed by the application of some oily spray as albolene-and-menthol solution, and be applied about

every other day. If the naso-pharyngeal vault contains adenoid granulations, these should be curetted.

Attention drawn to the benefit which occurs from removal of septal spurs, ridges, and exostoses in chronic naso-pharyngitis. They are extremely common in this connection and should be removed with the saw. C. H. Knight (Laryngoscope, Apr., '97).

Tumors of the Naso-pharynx.

Neoplasms of the naso-pharynx may be divided into four varieties, namely: *myxomata*, *fibromata*, *sarcomata*, and *carcinomata*. The most common of these are the fibromata, the malignant variety rarely appearing.

MYXOMATA are frequently found in the naso-pharynx, while their point of origin is located in the nasal passages. Thorner reported a case, however, in which a mucous polypus of unusual size had its origin in the naso-pharynx in front of the orifice of the Eustachian tube.

FIBROMATA are rare, occurring chiefly between the ages of ten and twenty-five. In no respect do they differ from similar growths in the nose. They spring from the periosteum or connective tissue of the vault, their point of attachment being the body of the sphenoid, the basilar process of the occipital bone, or the anterior surface of the upper cervical vertebræ.

Projections not infrequently extend into the nasal passages and occasionally appear at the anterior nares. They grow very rapidly, embracing and destroying by pressure the walls of the nasal passages and associated sinuses and more or less obliterating them. The so-called "frog-face" is very characteristic of this disease. These tumors are dense and resistant and are very prone to bleed under manipulation. The rhinoscope reveals a round, smooth, pinkish mass. The usual symptoms of post-nasal obstruction are present. Some cases are

characterized by severe bulging of the soft palate, while at the same time the tumor is seen to protrude below the palatine arch. After the growth has attained considerable size, headache becomes a marked symptom. The patient also appears dull and stupid. The disease almost always occurs in males.

Case of naso-pharyngeal fibroma in a girl of 15. The case is interesting on account of the rarity of these growths in women. Tellier (*Lyon Méd.*, Aug. 11, '89).

Fibroma of the naso-pharynx is almost exclusively confined to males from 15 to 25 years of age. Nélaton is quoted as not having "known of a single authentic example of true naso-pharyngeal fibroma in a female of any age, or in a male over thirty-five." Of 58 cases collected by Lincoln, of New York, all occurred in males under twenty-five. Woodson (*Laryngoscope*, Aug., '98).

After the age of 25 years fibromata seldom develop; when present after that age they tend to disappear spontaneously. Then, too, exceptional cases have been reported in which the tumor disappeared through a process of sloughing. Adhesions occasionally occur. Fibromata are not malignant, but sometimes become dangerous in consequence of encroachment upon neighboring structures. When the tumor extends toward the laryngeal cavity interference with deglutition takes place. The cranial cavity may also become involved or invaded by the tumor and create pressure on special nerves and severe pain. Deafness is not an unusual symptom and is produced by occlusion of the Eustachian orifice. Prognosis is favorable in most cases when complete removal is accomplished.

FIBROMYXOMATA are similar to fibromata, but do not tend to destroy the neighboring bones or cavities. The prognosis is always favorable.

SARCOMATA of the naso-pharynx are of

exceedingly rare occurrence. To distinguish between a benign and malignant growth of this region is sometimes difficult. The round-cell variety is that usually found in the naso-pharyngeal cavity. Age has no particular significance, as the disease has been observed in both young and old alike.

Treatment.—Evulsion with forceps is resorted to by some operators, a curved uterine écraseur by others. The galvanocautery-snare and puncture have their advocates.

I employ a powerful post-nasal snare designed by myself especially for this sort of surgical work. The aim should always be to take away as large a mass as is practicable with as little hæmorrhage as possible. The post-nasal snare fulfills this mission in several respects. To obviate great loss of blood, tamponing the upper pharynx and posterior nares is resorted to. To the tampons are attached oral and nasal ends of tape for purposes of fixation just before the wire is expected to sever the tumor from its base, after which procedure the snare is withdrawn. In the course of twelve or twenty-four hours the tampons can be removed without any loss of blood whatsoever.

Electrolysis when judiciously and properly applied holds a valuable and prominent position in the treatment of new growths of the naso-pharynx.

When the tumor is unduly vascular and cannot be manipulated without loss of blood, prior treatment with the electrolytic needle accomplishes considerable toward the limitation of hæmorrhage.

After the use of the post-nasal snare, the remaining base should also be treated by means of electrolysis; resolution is thus favored and the liability to recurrence becomes less marked. The so-called radical operation, for example, the excision of the superior maxillary bone

with a view of obtaining access to the naso-pharynx, seems unnecessary in any case. The radical method does not seem to accomplish any more than the operative measures above stated, and, at the same time immediately jeopardizes the life of the patient and certainly produces permanent disfigurement.

The accompanying catarrhal states will improve under the use of warm alkaline lotions. The douche or syringe does not recommend itself on account of the danger of forcing fluid into the middle ear, from which accident a more or less serious tympanic trouble may arise.

JACOB E. SCHADLE,
St. Paul.

NECROSIS. See JAWS and OSSEOUS SYSTEM.

NEPHRITIS. See BRIGHT'S DISEASE.

NEPHROLITHIASIS AND NEPHRITIC COLIC. See URINARY SYSTEM.

NERVES, PERIPHERAL, DISEASES OF.—The general conditions of disease to which any or all of the peripheral nerves are liable are: 1. Circulatory disorders. 2. Inflammation. 3. Degeneration. 4. Functional disorders. 5. Neoplasms.

Circulatory Disorders.

The circulatory disorders of any importance are: (a) Anæmia. (b) Hyperæmia.

(a) **ANÆMIA.**—This is a frequent accompaniment of general anæmic states, and is also seen as a result of obstruction of the blood-vessels of the nerves from atheroma or other cause, and also occurs with the vasomotor neuroses. The condition is of chiefly theoretical interest, since a positive diagnosis is always difficult and frequently impossible, the symptoms being various and oft-

times vague and lacking in characteristic features. Anæmia is doubtless in some instances a cause of neuritic pains and neuralgias, and some of the pains and paræsthesias accompanying the atheromatous arterial changes of old age are doubtless due to this condition. Almost any of the ill-defined peripheral motor and sensory abnormalities of the nerves may at times be presumptively traced to anæmia.

Treatment.—The successful treatment of the condition is based upon a recognition of its primary cause, and is directed toward the removal of this cause, together with the use of general tonics and hygienic measures calculated to improve nutrition and circulatory activity. In the aged and feeble, with diseased arteries, all remedial measures may prove disappointing.

(b) **HYPERÆMIA.**—This condition also is only recognizable with difficulty, although the symptoms are somewhat more definite and characteristic than are those of anæmia of the nerves. The most commonly observed symptoms are muscular weakness, tenderness or pressure along the course of the nerve; pain, darting, stabbing, or neuralgic in character; together with sensory perversions. A true neuralgia may have as its basis hyperæmia of the nerves. The symptoms are, it will be seen, much the same as those of an early stage of neuritis.

Etiology.—The causes of hyperæmia of the nerves are: adjacent inflammations, mechanical injuries, exposure to cold; bacterial, alkaloidal, metallic, and other poisons; rheumatism, gout, and other diathetic diseases; in short, the causes which, when intensified or prolonged, cause neuritis.

Treatment.—The best results in treatment are obtained from cold applications, leeches, cupping, and counter-

irritation. Massage and hydrotherapeutic measures are beneficial in chronic cases. Of internal remedies, potassium iodide and preparations containing iron give the best results.

Neuritis.

Inflammation of the nerves is, in most instances, associated with more or less degenerative change in the nerve-fibrils of the affected nerves. When the morbid process involves the nerve-sheaths and connective-tissue structures in particular we have an "interstitial neuritis," and the changes are chiefly inflammatory in nature. When the disease locates itself in the nerve-fibrils it gives rise to "parenchymatous neuritis": a condition partaking more of the character of a degeneration than of a true inflammation. In practice these two morbid states are usually combined—"diffuse neuritis"; so that, as indicated above, the so-called "neuritis" embodies both inflammatory and degenerative changes. There are many named varieties of neuritis, based upon etiological differences, intensity of the disease, its distribution, etc., and much confusion resulting therefrom. The practically important varieties are the following:—

(a) Traumatic neuritis, resulting from direct mechanical injury to the nerve, as from blows, wounds, pressure, etc.

(b) Neuritis from exposure to cold, sometimes improperly called "rheumatic."

(c) Neuritis caused by extension of disease from adjacent parts (tuberculosis, syphilis, bone disease, etc.).

(d) Forms of neuritis resulting from presence of bacterial poisons in the blood, exemplified in the neuritis accompanying or following typhoid fever, malaria, variola, syphilis, diphtheria, etc.

(e) Neuritis resulting from action of poisons introduced from without, such

as alcohol, lead, arsenic, mercurials, opium, etc.

(f) The endemic or epidemic form of neuritis, seen in tropical islands and sea-coast countries, the well-known "beriberi" (see BERIBERI, volume i).

(g) The neuritis accompanying certain skin eruptions or other trophic changes (HERPES ZOSTER, see volume iii).

Whatever the pathological nature or etiological origin of neuritis, if a single nerve or small group of adjacent nerve-trunks be affected it is called a "simple neuritis." If a number of nerves in different portions of the body be simultaneously invaded we have a "multiple neuritis." The neuritis from mechanical injury, exposure to cold, and other local causes is usually "simple"; the general infections, drug poisonings, and other toxæmias give rise most often to "multiple" neuritis. Of course, there are exceptions to these rules, since a general toxæmia may produce only localized effects—a simple neuritis—and a mechanical injury may involve a large nerve-trunk or several large nerves and give the symptoms of a multiple neuritis, as has been seen in cases of pressure upon lumbar and sacral nerves of a large aneurism. A simple neuritis is usually "interstitial"; a multiple neuritis is apt to be chiefly "parenchymatous."

Simple Neuritis.—A simple or localized neuritis arises from exposure to cold, involving in such cases nerve-trunks which lie near the surface of the body the most frequently observed clinical form being "Bell's paralysis," or "facial paralysis"; from traumatism,—blows or wounds; pressure, as from morbid growths; aneurisms, sleeping upon arms, crutches used long or injudiciously ("crutch paralysis"); and from tubercu-

lar or other disease which involves the nerves by extension from adjacent affected parts.

Neuritis caused by surgical operations is usually due to long-continued pressure during anæsthesia, either through force for maintaining the patient in position, by the dragging of the limbs of the table, or by the continued elevation of the arm over the head. To prevent this, the patient's arms should not be allowed to hang down, and care should be taken that during operation the weight of the body is as evenly distributed as possible. Keeping the body in any constrained position should be avoided when not absolutely necessary, and the use of any mechanical contrivance for maintaining a desired position should be with due care to prevent nerves from being stretched or pressed upon. H. T. Pershing (Med. News, Sept. 11, '97).

Number of curious cases of localized neuritis noted following slight injuries, such as too vigorous squeezing of the hands, injury by blow or pressure on the fingers, burning the skin with nitric acid, etc. Occasionally these cases are obstinate, and result in more or less permanent disability. Webber (Boston Med. and Surg. Jour., Nov. 5, '98).

The symptoms of brachial neuritis are pain, varying in degree, but often very severe; tenderness of the affected nerve trunks; weakness of certain muscles and limitation of movement; trophic changes, rarely severe; and sensory changes, such as anæsthesia and hyperæsthesia. Apart from injury, gout is the most prominent etiological factor. The duration is never less than three or four months, and it may last a year or more. Buckley (Lancet, Apr. 16, 1904).

Symptoms.—The symptoms of simple neuritis vary with the cause, nature, and location of the disease, but the true neural symptoms are essentially the same in all, consisting in perversion, exaltation, or, it may be, entire abolition of function of the nerves involved. There is usually pain, of a stabbing, darting character, felt in the parts to which the

nerve is distributed, with some pain and tenderness along the course of the nerve. This pain is partly due to pressure or irritation of the *nervi nervorum*, and may be very intense and distressing or may, as is often the case in mild forms of neuritis, cause little or no inconvenience. There is occasionally œdematous swelling and redness of the skin over the point of greatest inflammatory activity, and trophic cutaneous affections, sweating, and swelling of, and effusions into, joints sometimes appear. Tactile sensation is impaired in the affected area, and numbness and formication are frequent. Weakness in the muscles supplied by the affected nerves is the rule, reaching in the severer cases a complete paralysis. Muscular twitchings and spasmodic contractions are sometimes noted. In the severe and long-continued cases there is apt to be great atrophy of the affected muscles, which may be followed by contractures of fingers or toes or other parts involved. The nutrition of the hair and nails is often defective, leading to falling out or grayness of hair, deformities or dropping away of nails, etc.

The electrical reactions in simple neuritis vary with the intensity of the disease, being in the milder cases nearly or quite normal, but showing in all of the severe forms a partial or complete reaction of degeneration.

The duration of a simple neuritis depends chiefly upon the severity or curability of the initial lesion. The symptoms may pass off in a few days, or may persist for months. Recovery is the rule, and is always obtained, provided the cause is one which can be removed. In very unfavorable cases some permanent contracture or paralysis may result.

Pathology.—In simple neuritis the changes are chiefly localized in a limited portion of the nerve-trunk, only the

degenerative changes in nerve-fibres, where such a parenchymatous lesion is present, extending along the entire distal portion of the nerve. At the point of injury the nerve-trunk is red, swelled, and infiltrated with lymphoid elements, and may be surrounded by a gelatinous exudate. The changes involve especially the perineural and interstitial connective-tissue frame-work. In mild cases the nerve-fibrils themselves are slightly, if at all, involved; in severer cases, or where the fibrils have undergone compression from swelling of connective-tissue structures, the nerve-fibrils show the alterations of parenchymatous neuritis; their myelinic sheaths are fragmented, the nuclei of the sheath of Schwann and of the internodal cells are increased in number, or may seem swelled; in still more severe cases the axis-cylinders show marked degenerative alterations, become varicose, swell, disintegrate, and even entirely disappear, the appearances being then nearly identical with those of a true Wallerian degeneration. These changes in the axis-cylinders necessarily involve all of the nerve-fibre lying below the seat of injury, but are usually arrested at the first node of Ranvier above, although in some cases they may extend upward, even quite to the cord. The blood-vessels at the seat of an injury are often distended, and minute hæmorrhages into the nerve are of not infrequent occurrence. The disease may go on to complete destruction of the nerve-elements, the degenerated fibres being replaced by connective tissue and by fat-cells: a condition, when the fat-deposits are abundant, called by Leyden "lipomatous neuritis." Regeneration begins after a short time, and, if the original nerve-injury be removed, the nerve may, even in very severe cases, ultimately regain its former healthy state.

Many cases of mild neuritis pass unrecognized, being looked upon as rheumatism.

Peripheral neuritis may be isolated, confined to one or a few nerves; it may be multiple, symmetrical in its distributions, affecting the nerves of all the extremities. In isolated neuritis the disease begins in the nerve-sheath, constituting a "perineuritis," the inflammation extending to the nerve-fibres afterward. In the multiple forms the nerve-fibres themselves are the seat of the primary change, the sheath becoming affected later. These forms of multiple "parenchymatous" neuritis are always due to some virus in the blood, an organic or inorganic chemical compound usually. Isolated neuritis is due to some cause acting locally, and if several nerves are affected their distribution is irregular, not symmetrical. In these cases there is always a constitutional cause at work as well, predisposing to the disease.

The recurrence of neuritis as the result of medicinal use of arsenic is not very rare. Of predisposing causes in isolated peripheral neuritis, gouty and rheumatic conditions are among the most frequent. Lithæmia should be added to these. Lithæmia is probably the most frequent predisposing condition leading to the development of inflammation of the nerves after injury to them. Alexander McPhedran (*Med. News*, Oct. 31, '96).

Treatment.—As a necessary preliminary to any treatment, the cause of the disease must be removed. After this, rest of the affected part, absolute and continued for several days, should be insisted upon. The use of splints to limbs is sometimes advisable. Heat, especially moist heat,—as from steam, poultices, or fomentations,—gives great relief from the pain. Counter-irritation by mustard plasters or other means is sometimes equally efficacious. In many instances the galvanic current used in strength sufficient to redden the skin gives immediate and wonderful relief. Occasionally in early stages ice locally ap-

plied will give more relief than anything else. Of internal remedies, salol, the salicylates, and the whole series of coal-tar derivates—in particular, antipyrine, phenacetin, and acetanilid—may be used in the confident expectation of obtaining measurable relief from the pain. When other remedies fail the local hypodermic use of morphine is, where pain is very intense, justifiable. The early use of mercurials—calomel or blue mass—is often attended by good results. In any case the bowels should be kept open by salines or a simple purgative pill. Attention should be paid to the general health. In most instances tonics and alteratives will be found beneficial.

After subsidence of the acute stage and after all tenderness, redness in skin, pain in parts, etc., have disappeared, systematic massage and the use of faradic stimulation to the muscles will hasten restoration of function in muscles and cutaneous surface.

Static electricity has been successfully used for the cure of neuritis. The spark may be applied directly to the tender points even in the earliest stage. The patient may be connected with the prime conductor of the machine so that he does not form a part of the circuit, but is subjected to powerful electrical surging that are painless. Under this treatment relief is immediate, cure occurs usually within a short period, and it is not necessary for the patients to remain absolutely at rest. W. J. Morton and W. B. Snow (Med. Record, Apr. 15, '99).

Multiple Neuritis.

Synonyms.—Polyneuritis; disseminated neuritis; peripheral neuritis.

Definition.—This disease is a parenchymatous neuritis affecting many peripheral nerves at or about the same time.

Varieties.—Numerous varieties and forms of multiple neuritis are recognized, and of these the more important

have received distinguishing names, as is mentioned below. The varieties, as in the case of simple neuritis, arise from differences in nature, causation, severity, and location of the morbid process. The causes of multiple neuritis are: bacterial infection, toxic substances in the blood, anæmia, and dyscrasic states; in short, any state of toxæmia or malnutrition.

During pregnancy, and also after parturition, patients sometimes suffer from peripheral neuritis, which cannot be traced to any of the usual causes. This "puerperal neuritis" has been distinguished from neuritis caused by alcohol, lead, diphtheria, or septicæmia, and was described by Möbius as a multiple neuritis due to the circulation in the blood of a poison produced by the patient herself during gestation. It is quite distinct from "obstetrical neuritis," which is due to injury of nerve-trunks in the pelvis by instruments or by the child's head during labor, or to pelvic inflammatory conditions following labor. The symptoms and course of the disease are extremely like those of alcoholic neuritis, so much so that the diagnosis can only be made by excluding alcohol and other possible causes. Turney (St. Thomas's Hosp. Reports, vol. xxv, '98).

Main causes known to produce multiple neuritis: 1. Toxic cases due to the action of a poison derived from without the body: (a) metallic—arsenic, lead, mercury, copper, phosphorus, and silver; (b) non-metallic—alcohol, carbonic oxide gas, bisulphide of carbon, and nitrobenzol. 2. Toxæmic cases from infection. In this class are included all cases due to the development and action in the organism of some bacterial poisons either of external or of internal origin. 3. The third class of cases of multiple neuritis is allied to the second class, for, while not truly toxæmic or infectious, it is a class which Remak terms dyscrasic. There are certain diseases the presence of which in the system predisposes it to nervous affections, and among these affections it is now necessary to include multiple neuritis. Some of these are in themselves of bacterial

origin. Thus, tuberculosis is surely and rheumatism possibly so. 4. In this class we have to place many cases for which no cause can be discovered. These are so-called "idiopathic" cases, but as our knowledge of the causes of the disease increases this class diminishes. W. A. Starr (Medical News, Jan. 25, 1902).

Symptoms and Diagnosis.—The disease may come on suddenly and reach its greatest intensity within a few days (acute bacterial infections), or may show a slow and insidious onset (alcoholic and cachectic forms). The characteristic and ever-present features of the clinical picture are the abnormalities of nerve-reaction: *i.e.*, alterations in sensory, motor, reflex and trophic function of the nerves involved. The extraneural symptoms vary with the cause and nature of the initial morbid impulse. In the typical acute "idiopathic" cases and in cases accompanying acute infectious diseases the attack comes on with fever and the other usual features of the onset of an acute infectious malady. A chill may be the first indication. Headache and aching in the back and limbs are frequent, as are also loss of appetite, furred tongue, constipation and other evidences of gastrointestinal disturbance. The real nature of the case may be obscure for the first few days, but within this time the true neuritic symptoms make their appearance, and all doubt is quickly removed. Pain along the course of the nerves in legs or arms, or both, is noted, with tenderness in the muscles as well as in the nerve-trunk. Perversions of sensation now appear, in the form of tingling, formication, diminution in tactile sense, or hyperæsthesia or in rare cases anæsthesia. In addition to the above-mentioned tenderness on pressure the muscles in the parts affected become relaxed and flabby; there is weakness or even in severe cases complete paralysis. This

muscular weakness begins most frequently in the legs, extending upward by degrees, reaching the arms, when these become affected, some time after the symptoms in the legs are well established. In many cases typical "wrist-drop" and "foot-drop" are shown. The paralysis may reach the muscles of phonation, deglutition, and respiration, resulting in some degree of impairment of these functions. In severe cases, especially in those of rapid onset, the pneumogastric nerve may be involved, resulting in marked tachycardia. Trophic disorders are also of frequent occurrence, such as œdema, glossy skin, and herpetic eruptions in the area affected. The tendon-reflexes are usually diminished or abolished. In all save the milder cases there are changes in the electrical reactions similar to those of simple neuritis. The muscles lose their faradic excitability and with the galvanic current show a slow, worm-like contraction, with anodal closing contraction greater than the reaction to cathodal closure.

In multiple neuritis of septic origin the seat of the disease appears to be very variable; only the forearms or the legs may be involved, or the whole of the limbs, individually or together. Sometimes the gluteal muscles may be affected, also the external ocular muscles, and the parts supplied by the vagus. Psychical disturbances is very often present in addition. Hugo Kraus (Wiener klin. Woch., No. 40, '97).

Case of multiple neuritis and hæmatoporphyrinuria following the prolonged ingestion of trional. The cases of trional poisoning are interesting in that they bring vividly before us the etiological relationship existing between the ingestion of another of our synthetized organic drugs and the development of nervous affections. It is a well-recognized fact that the occurrence of neuritis has notably increased since the introduction and general use of the coal-tar products as remedies.

In personal case the whole amount of trional ingested was about thirty doses of 15 grains each: a total of 450 grains for two months. The onset presented the picture of a case of acute gastro-intestinal poisoning. Following this there was an acute degeneration of the kidneys and the presence in the urine of hæmatoporphyrin: a substance which is usually associated with poisoning of sulphonal and trional. The first of the nervous manifestations was a neuritis of the vagus and a subsequent trophic disturbance in the heart-muscle resulting in dilatation and valvular insufficiency.

The more marked affection of certain definite groups of muscles—*e.g.*, the extensors of the wrists and feet—suggests the selective action of trional for certain nerves or groups of cells in the anterior horns of the cord, not unlike that of the metallic poisons.

The nerves recovered their function in the same order in which they were impaired, *viz.*: first the vagus, next those of the extremities of the left side of the body, and last those of the right side. Stuart Hart (*Amer. Jour. Med. Sci.*, Apr., 1901).

The intensity, rapidity of onset, course, and duration of multiple neuritis vary considerably in different cases. In some the pain is scarcely noticeable, the motor symptoms predominating. In mild cases there may be only slight stiffness or weakness of the muscles, passing off in a few days. In other cases the pains are violent and excruciating, and the paralysis of the muscles is total and long continued, months elapsing before the patient regains use of the paralyzed limbs. Deaths are not infrequent, occurring during the acute stage from failure of respiration or heart-action, and in chronic stage from exhaustion or intercurrent complications, as pneumonia, pleurisy, or tuberculosis.

With few exceptions the prognosis of peripheral neuritis is good; recovery will be long delayed in severe cases, and

in a few acute cases a fatal termination occurs within a few days or weeks.

Bad cases grow worse for weeks or months and then remain stationary for a time. Complete recovery requires several months. Alexander McPhedran (*Med. News*, Oct. 31, '96).

In cases with involvement of the spinal cord the prognosis is unfavorable.

In all except the mildest cases of neuritis recovery is slow, and is preceded by a stationary period, which lasts one or two months. Some power may be regained after two or three months, but the average duration of the weakness is six or seven months, and it may be a year before all the muscles recover. C. L. Allen (*Med. Rec.*, Apr. 24, '97).

Out of 49 cases of peripheral neuritis, in 14 cases there was either no recovery or but partial cure. In 22 cases recovery was complete, while in 13 no mention was made of the termination. Reynolds (*Brit. Med. Jour.*, No. 1920, '97).

In cases of multiple neuritis from other causes than acute bacterial infection there are few constitutional symptoms: a more gradual onset and a greater chronicity. The diagnosis, also, is easier, since the neural abnormalities are not masked to such an extent by the symptoms of acute disease.

It should be remembered that the characteristic symptoms of multiple neuritis and those upon which a diagnosis must rest are the motor, sensory, reflex, and trophic nerve-disorders; the gastrointestinal, cardiac, respiratory, and other occasional features may or may not be present; and to the symptoms of any multiple neuritis may be added the complicating clinical picture of some acute disease to which the neuritis is possibly due. If the nerve-reactions are tested for, there will be little danger of error in diagnosis. In the acute cases of sudden onset in which tachycardia and respiratory distress, with general cedema, pallor of surface, loud heart-murmurs, etc., are present the peripheral nerve-dis-

orders are masked and the case is liable to be regarded as one of acute "heart-failure" or "Bright's disease" unless careful tests are made for neural symptoms. Chronic cases resemble in many particulars locomotor ataxia; the characteristic gait, the lightning pains, girdle sensation, and absence of muscular weakness in ataxia ought, however, to render a diagnosis easy.

Although many cases of alcoholic neuritis have a resemblance to tabes, yet in neuritis muscular weakness and physical disturbances are among early symptoms, while in tabes they usually develop late in the disease. Bernhardt (*Berl. klin. Woch.*, July 14, 21, '90).

The onset and course of acute anterior poliomyelitis is not unlike that of acute peripheral neuritis. The fact that the former occurs in children, the latter in adults, and the absence in poliomyelitis of the marked sensory symptoms of neuritis are sufficient distinguishing points.

The disease is of frequent occurrence, coming often within the notice of both the neurologist and general practitioner of medicine. The alcoholic, syphilitic, post-febrile, and toxic forms are common in all climates. In the southern United States malarial and idiopathic forms are often seen, and two instances of the occurrence of the epidemic variety (beriberi) have been reported, one at Tuscaloosa, Ala., and one at Little Rock, Arkansas, both among insane patients, both epidemics during 1895-96.

Pathology.—We have to deal in multiple neuritis with a general toxæmia or nutrition deficiency in the blood, causing degenerative changes in the nerve-fibres of the peripheral nerves, associated in some instances with such inflammatory changes as were described under simple neuritis. The peripheral ends of the nerve-threads, being farthest removed from the trophic centre (the cell-

body), show the first and most pronounced changes. In severe cases the entire cell may become involved or be destroyed. The anatomico-pathological changes are similar to those described under simple neuritis.

Case in which the double etiology of alcohol and lead was represented in the production of multiple neuritis for the following reasons: In the first place, the presence of the blue line on the gums and the history of an attack of lead colic are sufficient evidence of the presence of lead in the system in sufficient quantity to produce changes in the nervous system. In the second place, the predominance of extensor involvement as exhibited in the bilateral wrist-drop, with a fair preservation of the grip and all forms of sensation, follows the usual clinical picture of lead palsy of the upper extremities. The evidence in favor of the presence of the alcohol as a factor in the production of the neuritis is found in the predominance of the changes in the peripheral, intramuscular nerve-filaments in the lower extremities over the trunk changes. The muscles were very sensitive to pressure even after the acute symptoms had subsided, while the nerve-trunks were only moderately sensitive, and only deep pressure elicited pain.

Sensitive and painful muscles are as rare in cases of lead neuritis as they are common in alcoholic neuritis. Wrist-drop, on the other hand, is so frequent in lead neuritis that it is looked on as the typical clinical picture of that disease. An intense atrophy coming on rapidly after the development of the neuritis—less than four weeks—is rare in either form of neuritis, and is practically never met with in lead. One must look on it as an evidence of an intense change taking place either in the peripheral nerves or the anterior horn-cells of the spinal cord, or both, induced by the double intoxication. D. J. McCarthy (*Phila. Med. Jour.*, Mar. 23, 1901).

Treatment.—The treatment of multiple neuritis should first be directed toward the removal of the cause and the relief of the pain and acute symptoms;

after this, measures which hasten regeneration of nerve- and muscle- fibres are indicated. In idiopathic cases a full dose of calomel, followed by a saline, is beneficial. Intestinal antiseptics also aid. The pains are controlled by hot applications, dry or moist, and by the coal-tar derivatives and opium. After subsidence of the acute stage, massage and rubbings of affected parts, with faradic electricity, give the best results in hastening regeneration. Systematic exercise should be advised as soon as the condition of the muscles permits of it. Tonic doses of strychnine and arsenic seem to hasten recovery. In the distressing case in which tachycardia is a prominent symptom all heart-stimulants are apt to prove of no avail, the best results being obtained from cold applications to the chest. In the paralytic cases where, after long-continued helplessness, contractures and permanent deformities are threatened, passive movements and, if need be, fixation of limbs by means of properly-adapted splints may be required.

If the symptoms of peripheral neuritis in pregnancy are very severe, the labor should be terminated, as after delivery recovery sets in. G. Elder (*Lancet*, July 25, '96).

In treatment of multiple neuritis the cause should first be removed. For the neuritis this is no specific remedy. Anodynes may be required to relieve the pain. Rest and protection of the parts from injury are of importance. Some satisfactory results from use of strychnine, especially by subcutaneous injection: $\frac{1}{30}$ to $\frac{1}{20}$ grain, twice daily. As soon as the tenderness has abated, massage and baths will prove useful. In the later stages the rousing of the patient's latent energies and encouraging him to make voluntary use of the muscles, as far as possible, will do more to accomplish the objects in view than any other plan of treatment. A. McPhedran (*Med. News*, Oct. 31, '96).

Case of alcoholic neuritis in a man which was cured by administration of 0.1 grain of strychnine four times daily. Houghton (*Med. Rec.*, Jan. 14, '99).

The more important varieties of multiple neuritis are the following:—

SYPHILITIC NEURITIS.—This occurs as a result of syphilitic infection. The onset is afebrile and insidious, acute, active symptoms being wanting. The course is chronic. Some cases resemble tabes ("syphilitic pseudotabes").

Treatment.—The cure is effected through removal of the syphilitic poison by iodides, hot baths, massage, and electricity.

ALCOHOLIC NEURITIS.—Caused by chronic alcohol poisoning. Gradual onset, without fever or disturbance of general bodily functions. Chronic course. Cure usual, through removal of cause. (*Vide* article on ALCOHOLIC NEURITIS in volume i.)

Two interesting cases of trophic degeneration of the vessels following peripheral neuritis. First case was a man with alcoholic history, who developed symptoms of a general peripheral neuritis; showed gradual enfeeblement of the circulation in the extremities, followed by partial gangrene of the toes. Vessels of the extremity were to be felt as thickened cords, and microscopical examination showed an obliterating endarteritis. A neuritis was also shown to exist. In the second case there was a neuritis of one leg and arm, with an ulcer on the sole of the foot. Both by the course of these cases, and also by personal observations of cases with old vascular lesions, it is shown that the nervous lesion is the primary one. Lapinsky (*Arch. de Méd. Exper.*, Jan., '99).

ARSENICAL NEURITIS, SATURNINE NEURITIS, and other related forms are due to injudicious or excessive use of arsenic, lead, or other similar drug.

These are readily curable through removal of the cause.

POST-FEBRILE NEURITIS, following

typhoid or other fever, DIPHTHERITIC NEURITIS, SCARLATINAL NEURITIS, etc., are caused by the poisons of these infectious diseases. The neural symptoms are complicated by the features of the associated germ disease. Disappearance of the acute disease is followed by recovery.

MALARIAL NEURITIS occurs in malarial localities, not always accompanying or following malaria, but occurring in some persons in a community while others suffer from malaria. Onset, course, clinical picture, and terminations as in idiopathic forms. It resembles beriberi in some particulars.

Treatment.—Quinine and, where possible, change of residence are indicated.

In a form of multiple neuritis in the West Indies the patient presents himself complaining of numbness and cramps in hands and feet, dimness of vision, and tightness round the waist. There is also a burning sensation in the soles of the feet and in the palms of the hands, worse at night usually than in the day, and there is, as a rule, slight excoriation with fine desquamation at the edges of the eyelids and at the margins of the lips and nostrils. The main nerve-trunks in the limbs are tender to pressure, and this is particularly true of the ulnar nerve, and along the distribution of the terminal filaments are fine herpetic vesicles. The muscles of the limbs waste and the trunk-muscles may become involved and lead to respiratory difficulty. The pupillary reaction is not impaired, although vision is much reduced.

The mental condition is unimpaired except in the extreme cases in which delusions may be present. The reflexes do not differ in their condition from the condition of these phenomena found in other kinds of neuritis. Malaria is the most probable toxic agent, although the poison may be the result of some micro-organism or other agency at present unknown. Strachan (Practitioner, Nov., '97).

ENDEMIC NEURITIS, or BERIBERI, caused probably by specific bacterial in-

fection, is rarely seen save in the tropics, near the sea-coast. (See BERIBERI in volume i.)

TUBERCULAR NEURITIS, RHEUMATIC NEURITIS, SEPTICÆMIC NEURITIS, DIABETIC NEURITIS, and many other forms are spoken of by writers. Their nature is sufficiently indicated by the name.

Functional Disorders.

Varieties.—The functional disorders of the peripheral nerves may be classed as motor, sensory, and mixed forms.

The motor functional neuroses of peripheral origin are:—

(a) "Recumbent palsy," "night-palsy," or "waking numbness," characterized by temporary paralysis of one or more extremities, is noticed after lying still for a time or upon awakening in the morning. The symptoms are much the same as those seen when a nerve is compressed, as when a limb "goes to sleep"; but are not caused by pressure, and should not be confounded with the pressure paralyses. It is a rare condition, occurs in neurotic subjects, and its causation and pathology are unknown.

(b) Spasm and tremor, occurring from overuse of muscles and frequently associated with some form of "occupation neurosis."

The peripheral sensory neuroses are:—

(a) Neuralgia, elsewhere described.

(b) Paræsthetic neuroses, an affection closely akin to and sometimes associated with the waking numbness above mentioned. It is a condition of little practical importance.

The mixed peripheral functional neuroses are:—

(a) Erythromelalgia, characterized by neuralgic pain and congestion in the feet occurring after severe exertion or as a sequel of wasting disease. Some form of neuritis may be associated with it.

Acroparæsthesia resembles erythromelalgia only because of the presence in both of paræsthesia and hyperæsthesia. In no other particulars are these conditions similar. Acroparæsthesia is associated with numbness and falling asleep of the fingers and formication. There are but few objective sensory disturbances; oftener there are none. There are no vascular symptoms; there is considerable motor weakness; if there is change in the color of the fingers, they are pale, not red; the hands are abnormally cold; in some cases the temperature is reduced from $1\frac{1}{2}^{\circ}$ to 2° C. Friction, walking, and movement of the parts reduce the discomfort, while in erythromelalgia these aggravate the torture. There is greater intermission in the symptoms in acroparæsthesia, while in erythromelalgia they finally become continuous; in erythromelalgia the reflexes are exaggerated, while in acroparæsthesia they are normal. The vascular storm is absent in the latter; decidedly in evidence in the former. Of 162 cases of acroparæsthesia, 150 were women; only 12 were men. The majority of cases of erythromelalgia are found in men. Acroparæsthesia affects anæmic, cachectic, and overworked adults; in middle life and women at the climacteric, particularly those who work in cold water. In erythromelalgia there are, besides the predilection of the disease to attack the lower extremities, complications referable to the digestive system with far-reaching central, spinal, or peripheral changes in many cases. H. L. Elsner (Med. News, Mar. 16, 1901).

Acroparæsthesia, erythromelalgia, and the other many and varied vasomotor symptoms have certain features in common: 1. They are much more frequently met with in the female sex—something like 90 per cent. of these cases occur in the female patients. 2. Vasomotor conditions appear to be due to some inherent and very often inherited tendency in the patient, for they recur again and again in one form or another during the life of an individual. Thus, a patient may have migraine at one time, severe flushings at another, and syncopal attacks at another, though there is a tend-

ency to a recurrence of the same disorder. There are, moreover, two epochs of life which are specially prone to their development, namely: puberty and the climacteric. 3. The onset of the symptoms, whatever they may be, is always more or less sudden. 4. They are in all cases paroxysmal: *i.e.*, they occur in the form of attacks. There is a sudden rise, when the symptoms soon reach their acme, followed by a gradual descent. In severe cases the attacks may be so frequent as to resemble a continuous malady, but close observation will show that there are well-marked exacerbations. 5. In the great majority of the patients flushes or flush-storms occur from time to time during the patient's life; should these be absent there are generally other evidences of vasomotor instability. 6. A great many of them—particularly of the vasodilator kind—are amenable to treatment by bromides, which relieve them, at any rate, for a time. T. D. Savill (Lancet, June 1, 1901).

(b) Raynaud's disease, a symmetrically occurring affection of fingers or toes, marked by angiospasm, coldness, pain, mottling, swelling, and eventually gangrene. It is a rare disease, is usually associated with anæmia or some form of toxæmia, and may be complicated by neuritis. It has by some been regarded as a neuritis, but the weight of evidence is against this view, and in the present state of our knowledge the disease may properly be included among the functional neuroses.

Neoplasms.

Tumors growing in or upon the nerve-trunks are either true neuromata—*i.e.*, tumors composed of medullated nerve-fibres or other nerve-tissue—or are false neuromata,—*i.e.*, composed of other than nerve-tissue. The "false" neuromata are usually of secondary origin; that is, extend to the nerve from adjacent structures, the most common kinds being fibroma, sarcoma, myxoma, and the

syphilitic and tubercular growths. They need not be considered here, attention being directed only to the true nerve-tumors.

NEUROMA occurs singly or in numbers reaching into the thousands. When "multiple" they are usually small, and form shot-like, but quite painful, nodules under the skin. When few in number they are apt to be larger in size, being occasionally an inch or more in diameter. The causes of neuroma are, in the multiple form, hereditary predisposition, and, in the simple form, injuries to the nerve-trunk from blows, surgical operations, etc. The knob-like masses which develop upon the ends of the nerves of the stump after amputation offer a good example of this form of neuroma.

The symptoms of neuroma, beyond the presence of the tumor, are often *nil*. In some instances, however, there is pain, paræsthesia, or paralysis in the affected nerve-area. Occasionally the pain is intense, distressing, and neuralgic in character, as is seen in post-amputation neuromata.

In neurofibromatosis the tumors are both cutaneous and connected with nerves. They are of variable consistency and resemble mollusca. Usually the face is spared, also the palms of the hands, soles of the feet, and the genitals. Often they are distributed along a nerve-trunk like a string of beads. Pigmentation is frequently in small spots, but large colored areas may be seen. The patients often have loss of memory and show some difficulty in comprehension. Slowness of movement, tremors, and epileptiform seizures are noted among the motor disorders; and vague anæsthesia and paræsthesia, with painful cramps, among the sensory disorders. Feindel (Jour. de Méd., Mar. 10, '97).

Treatment.—No treatment is called for unless there is pain or other interference with nerve-function, when sur-

gical measures, usually a total excision, are called for and give relief.

When examined microscopically true neuromata are found to consist of nerve-fibres, medullated or non-medullated, with occasionally a few ganglion-cells interspersed, these nerve-elements being mixed with some fibrous tissue. When the fibrous tissue is abundant the growth is spoken of as "fibroneuroma."

Diseases of Special Nerves.

The several conditions of general disease above described may, when involving special nerves, give rise to well-defined clinical symptom-groups meriting brief description.

Diseases of the nerves of *special sense*—the olfactory, optic, auditory, etc.—are dealt with by specialists and are, to a large extent, devoid of general interest. The affections of the optic nerve, of which neuritis is the most important, are of value in the diagnosis of intracranial lesions.

Disease of the 3d, 4th, and 6th pairs of cranial nerves leads to abnormalities of ocular movement, whose consideration falls within the domain of the eye specialist, although the lesions are often of value in diagnosis of brain diseases.

The acoustic tumor syndrome is well defined, and the diagnosis can be made with practical certainty. This presupposes not only the diagnosis of the location of the tumor, but its nature and comparative size. It must, however, be observed that other slowly growing pathological conditions in the posterior fossa might simulate closely this condition. The slow and essentially benign nature of the growth, its non-infiltrating character and enucleability would all favor surgical interference. The deep situation at the base in immediate proximity to vital centres offers *very serious obstacles*. From personal observation, the writers believe that the surgical technique should be perfected along the following lines: 1. The avoidance of undue concussion in the removal of

the bone and enlargement of trephine opening. 2. A method of extirpation by which the tumor could be extirpated without undue manipulation of the surrounding parts. 3. The division into stages, as recommended by Horsley, and celerity of execution. Joseph Fraenkel, J. R. Hunt, George Woolsey, and C. A. Elsberg (*Annals of Surgery*, September, 1904).

The most important disorders of the fifth cranial nerve are neuralgia and headache, elsewhere considered. (See NEURALGIA AND MIGRAINE.)

The seventh cranial nerve may be affected by spasm or convulsive tics, or by the not uncommon and clinically important "Bell's palsy," or facial paralysis.

Facial Paralysis.

This is a motor paralysis affecting the muscles of usually one side of the face.

Symptoms.—The onset of a facial paralysis is usually sudden, or of rapid development, and is indicated by loss of power in the muscles of one lateral half of the face, with loss of emotional as well as of voluntary movements. The affected side is expressionless and smooth, the lower eyelid droops, and the eye cannot be entirely closed. The tears accumulate and run down the face. The lips are relaxed and powerless, and ability to drink, chew, articulate, etc., is impaired. The mouth is drawn toward the affected side, this and other evidences of paralysis being exaggerated when the patient laughs or smiles. The affected side may show some congestion or circulatory defect, and occasionally an herpetic eruption appears. The soft palate and tongue are not involved, although, on account of the displacement of the mouth, the tongue seems to deviate from the median line. The sense of taste in the anterior part of the tongue is lost in a small proportion of cases. There are few or no sensory abnormalities.

The electrical reactions are the same as are seen in other forms of peripheral neuritis, their exact character depending upon the severity of the case, and for this reason possessing an especial value in prognosis. Thus, if the electrical reactions are nearly normal the case is a mild one, and recovery will most likely take place within a few weeks. If the excitability of the nerve to galvanic and faradic currents is lessened and that of the muscles to galvanic current increased and formula altered ($An.Cl.C. > K.Cl.C.$: contraction sluggish) the case is still favorable, recovery being probable within six to eight weeks. When complete reaction of degeneration is present,—that is, when faradic and galvanic excitability of nerve is lost, faradic excitability of muscle lost, galvanic excitability of muscle increased, and formula and nature of contraction altered as above,—the case is serious and will not recover for many months.

The usual outcome of a peripheral facial paralysis is complete recovery. In the few cases which terminate unfavorably the paralysis and resulting facial asymmetry may be permanent. There is atrophy of facial muscles in all severe cases, and some degree of atrophy as well as some contracture may, in the more serious cases, persist.

Diagnosis.—The diagnosis of a facial palsy is simple, inspection being all that is required in the majority of cases. The only question is whether the lesion is central or peripheral. The peripheral cases show changes in electrical reaction, impairment of emotional movements, loss of reflex movements, and persistent paralysis of eyelid, these conditions being reversed in central paralysis. A central lesion also is usually associated with some other symptoms of intracra-

nial disease, often a hemiplegia. The seat of the lesion can often be accurately located. If the facial nerve alone is involved and the sense of taste is unimpaired, the lesion is in the trunk of the nerve, outside of the skull, or is just within the stylo-mastoid foramen. If the sense of taste in the anterior portion of the tongue is affected, the lesion is in the Fallopian canal. If complete deafness occur with the facial palsy, disease in the trunk of the nerve at the base of the brain is indicated, while, if there is associated paralysis of the sixth nerve, the lesion is probably located in the pons.

Etiology and Pathology.—Facial paralysis may be due to a lesion involving any part of the facial nerve-tract from the motor centre in the lower Rolandic area of the cortex to the face-muscles of the opposite side. If the lesion lie in the cortex or between cortex and facial nucleus in the pons, we have a “supranuclear” facial paralysis. If the lesion involve the nucleus in the pons, we have to deal with a “nuclear” paralysis. If the fibres of the nerve itself be affected, the term “infranuclear” is applied. A supranuclear or central paralysis is usually seen in association with a hemiplegia; the electrical reactions remain unaltered, the upper muscles of the face are but little involved, and voluntary movements are more impaired than is the power of emotional expression.

The peripheral form of Bell’s palsy, or facial paralysis, that arising from lesions of the nerve-trunk or nerve-roots in the pons, is one of the most common of the peripheral paralyses. It is more often seen in early middle life, and in men than in women. The great majority of the cases have as their basis a neuritis of the facial nerve, due to exposure to cold. Such cases are some-

times referred to as “rheumatic.” Other causes are injury to the nerve-fibres, as from accidental cutting during surgical operations upon the neck, or from blows, compression, temporal-bone disease, etc.

Treatment.—The pathological process underlying the paralysis, when such exists, should be first dealt with. In the common neuritic cases a mercurial purge should be given in the beginning, followed by counter-irritation over the affected nerve-trunk, in the form of a blister, the actual cautery, or a strong galvanic current. The internal administration of salicylates or salol, continued for some days, is advisable. Iodide of potassium is almost always beneficial, even in cases destitute of syphilitic taint. It should be given in moderate doses, continued for a long time. After subsidence of the acute symptoms facial massage and the local application of the faradic current in strength sufficient to produce muscular contraction will serve to hasten restoration of power to the paralyzed muscles.

Localized Neuritis.

Disorders of the GLOSSO-PHARYNGEAL, or ninth pair of cranial nerves, are attended by perversions of the sense of taste, as well as by abnormalities of common sensation and motion in parts to which the nerve is distributed. The nerve may be affected alone, but is most often involved, along with the hypoglossal, in the (nuclear) changes of bulbar paralysis.

The PNEUMOGASTRIC nerve, with its extensive distribution and varied functions, gives, when affected by disease, a many-sided clinical picture, the more prominent features being cardiac irregularities and gastric disorders. The nerve is rarely alone involved, but not infrequently participates in the morbid changes of multiple neuritis, or beriberi.

It may also be affected from injury, as a result of pressure from a tumor, etc. The tachycardia and acute gastric symptoms pertaining to disease of the pneumogastric nerve have already been referred to under multiple neuritis.

Some of the cases of "nervous" dyspepsia are attributable to disorder of the vagus. Some forms of paralysis of the larynx and pharynx, as well as some of the laryngeal neuroses, depend upon disorder of this nerve.

In 15 recorded instances in which the pneumogastric was accidentally involved in malignant disease or merely in accidental injuries 11 died and 2 recovered, while in 2 instances the result was not reported. It is impossible to separate the causes of death so far as distinctly to state whether death was due to lesion of the nerve-trunk itself or to coincident lesions of other important structures.

Of 50 other cases the result is left in doubt in 2 instances, while, of the remaining 48, 21 died and 27 recovered. Here, too, in the fatal cases, it is impossible to say that in any instance death was due to injury of the nerve.

The preponderance of testimony is in favor of the comparative safety of attacking this nerve when involved in disease and when too much other operating is not necessitated by the condition for which intervention is undertaken. Roswell Park (*Annals of Surg.*, Aug., '95).

The SPINAL ACCESSORY nerve may be affected by a neuritis, rheumatic or other, or by injuries, tumors, etc. The result is paralysis or weakness of sternomastoid and trapezius muscles. Spasmodic wryneck is sometimes traceable to spinal accessory disease.

The HYPOGLOSSAL nerve is often involved as a part of a bulbar palsy, or in course of general paresis or other degenerative nervous disease. The prominent symptoms are paralysis and atrophy, with fibrillary tremor in the side of the tongue, with deviation of the tongue toward the sound side.

Neuritis of anterior crural nerve in childbed observed in 17 out of 1000 patients. Pain in the thigh began on about the third day, and there was distinct tenderness over point where the anterior crural nerve passes under the crural arch. It radiated to the hip, knee, and part of the foot supplied by the long saphenous nerve. In all cases the presentation was vertex, excepting 2 breech and 1 footling. Delivery was spontaneous in the remaining 13 cases. The cause of puerperal neuritis of the anterior crural is obscure. Sepsis is out of the question, none of the cases showing evidence of such a condition. Meyer (*Centralb. f. Gynäk.*, No. 25, 1901).

Inflammation of Spinal Nerves.

The noteworthy diseases of the spinal nerves are the general conditions of neuritis, degeneration, etc., already described; the painful affections included under the term neuralgia (*vide infra*); and the affection known as sciatica, now to be dealt with.

Sciatica.

This is to be regarded as a form of neuritis chiefly interstitial in character, the pathological changes being located in the nerve-sheath. In severe cases the nerve-fibrils are also affected. The lesion is usually localized at the sciatic notch and near the middle of the thigh, and the pathological alterations shown are those of simple neuritis, previously sketched.

The malady is most common in middle life, and is seen more frequently in men than in women. The remote or predisposing causes are general malnutrition; rheumatic, gouty, and uric-acid diatheses; digestive defects, syphilis, and anything which lowers general vital tone. The exciting causes are exposure to cold, muscular overstrain, and direct injury, as from pressure or blows.

A careful examination of the pelvic viscera will frequently reveal the cause of a sciatica, prolapse of the uterus

with retroversion, prolapse of the rectum, an inflamed ovary or testicle, varicocele, an inflamed or tender prostate, and hæmorrhoids are especially conductive to sciatica, while fissure in ano, stricture of the rectum, stricture of the urethra, impacted fæces, and tumors in the pelvic cavity are also causes. Pressure along the course of the nerve, continued for a long time, may produce an attack of sciatica, as will, also, exposure to cold. F. B. Bishop (*Virginia Med. Semimonthly*, July 8, '98).

Symptoms.—The characteristic symptoms of sciatic neuritis are pain and tenderness along the course of the sciatic nerve, with weakness and a sensation of stiffness in the muscles. The onset of the pain is usually gradual, it being at first felt only on exertion, but, as it becomes more severe, being constant. It is at times a dull ache; at others a sharp lancinating or acute burning pain. Formication, tingling, and some degree of anæsthesia are common. In later stages there is some atrophy of the calf and other muscles supplied by the sciatic nerve, and in a few instances the disease extends to the lumbar plexus of nerves.

Trophic disorders, as œdematous swelling and herpes, are of not infrequent occurrence.

In about one-third of the cases of sciatica personally seen during the past eight years loss of the knee-jerk on the affected side noted. Raven (*Brit. Med. Jour.*, Mar. 19, '92).

Attention called to the abolition of the tendo-Achillis reflex in sciatica, and its value indicated as a differential sign between true sciatica and hysterical pseudosciatica. J. Babinski (*La Méd. Mod.*, Oct. 26, '98).

The disease endures for weeks, months, or even years, although eventual recovery is the rule. Most cases last for months. The more acute and severe the initial symptoms, the longer the case will probably last. An obstinate form of neuralgia may persist after the other

symptoms of sciatic neuritis are entirely gone. Secondary sciatic neuritis, from pressure of a tumor or a similar cause can, of course, be relieved only after removal of the cause.

Two cases of sciatica in which Kernig's sign (which was originally described in meningitis), occurred with great distinctness. Kernig's sign as is well known, is the contraction or flexure of the knee and hip joint, which occurs when the patients assume the sitting posture. The patient is unable to extend the lower limbs completely when sitting, and the contraction of the flexor muscles amounts to 135° in slight forms, and 90° in marked cases. In 1898 Netter, of Paris, declared this sign to be pathognomonic of meningitis, and asserted that it occurred in 90 per cent. of all the cases of this disease. This sign has been since then found in typhoid fever by Cipollina and Maragliano, and this without any meningeal complications. Salomni found it in a case of rigidity of the spine, and Sailer in a case of extensive hæmorrhage of the right hemisphere. In 1902, Magri for the first time found it in a case of sciatica, the patient afterward dying of typhoid fever, without a trace of meningitis. Since then a few cases of sciatica have been reported in which Kernig's sign occurred. The writer in the present cases found the sign in its characteristic form, and observed that it disappeared gradually with the symptoms. He considers Kernig's sign as a muscular reflex induced by the irritation of the nerve filaments. Plessi (*Gazzetta degli Ospedali e delle Cliniche*, Apr. 3, 1904).

Treatment.—In the treatment of sciatica the first requisite is absolute and complete rest of the limb, all movements which give the least pain being scrupulously avoided. Simply confining the patient to bed may answer in many cases, but in the aggravated forms placing the limb in splints is advised. Hot applications, as hot poultices, superheated air, etc., are grateful in relieving the pain,

while occasionally *ice* is more useful. Counter-irritation by the actual cautery gives great relief sometimes. A strong galvanic current is always of service. The local hypodermic administration of drugs is preferable to the use of drugs by the mouth. Cold water injected into the muscles gives great relief. Acupuncture is frequently of great value. Where local remedies fail the internal administration of coal-tar products or morphine may be necessary.

Surgical measures, such as nerve-stretching, splitting the sheath, etc., may be tried as a last resort. The diet should be liberal and the general bodily state improved as much as possible by tonics and hygienic measures. In the later stages of the malady electricity and massage should be used systematically, as they shorten the period of convalescence.

One hundred and thirteen cases of rebellious sciatica in which compression resulted in recovery. Patient lies on his face, with his legs extended and resting easily one against the other. The most painful spot is selected: the region where the nerve proceeds from the large sciatic opening. On its trunk both thumbs are applied and it is compressed with the greatest possible force; at the same time slight lateral movements are made without changing the point of pressure or moderating its intensity. This takes from fifteen to twenty seconds, and is followed by an interval of twenty minutes' rest, when the procedure is repeated. After a second application patient is able to walk, and for several hours, or even a day, he may be free from pain.

In order to obtain complete recovery, this procedure should be practiced about six times a day every two days, until definite suppression of neuralgia is obtained. M. Negro (Bull. Méd., Jan., '96).

Nitroglycerin, in doses of 1 minim of the 1-per-cent. alcoholic solution and increasing up to 5 minims three times daily, successfully given to seven pa-

tients suffering with sciatica. In the acute cases they recovered in from ten days to a month; in the chronic cases they improved notably and gained daily. Only discomforts arising from the use of this drug were congestive headaches and flushing of the face sometimes following the first dose of the medicine, while in others they did not supervene until the maximum doses were administered. To counteract these effects the bromides may be used. If after a period of administration of ten days no perceptible effects have been obtained, it should be abandoned. Treatment of anæmic conditions, diathesis, and local causes must be considered and carried out in conjunction with the special treatment. W. C. Krauss (N. Y. Med. Jour., Feb. 29, '96).

In sciatica deep injections of glycerophosphate of soda recommended very highly. One to two cubic centimetres of a 25-per-cent. solution are to be injected deeply into the muscle as near as may be to the nerve. Of 63 cases treated in this manner, 41 were cured, 18 ameliorated, while in only 4 was the treatment a failure. Constitutional treatment is not to be neglected when the neuralgia is a symptomatic one. Albert Robin (Bull. Gén. de Thér., May 30, '97).

Deep injections of antipyrine into the muscle in the region of the sciatic nerve promptly relieves sciatica. A long needle is employed, and the injection made at a point nearly midway between and a little below a line drawn from the tuberosity of the ischium to the great trochanter, the antipyrine solution being slowly injected at a vertical depth of about half the length of the needle. Kühn (Sem. Méd., xviii, p. 54, '98).

In the treatment of sciatica by electricity each case must be a law unto itself. Splendid results obtained personally from a high tension, alternating current, combined with the direct current. F. B. Bishop (Virginia Med. Semi-monthly, July 8, '98).

Twelve cases of rheumatic sciatica treated with strong hydrochloric acid applied to areas several centimetres in diameter over the tender points in the

course of the nerve and at the side of the vertebral column, every second or third day, and reapplied after the effects of the preceding application have passed off. The pain caused by it is slight. From four to eleven applications are necessary. Von Eljasz-Radzikowski (*Ther. Monats.*, Aug., 1900).

Two obstinate cases of many years' duration in which salophen alkaline solution, each 10 cubic centimetres containing 1 gramme of salophen, injected into the gluteal muscles every other day. After the eleventh injection the pain practically gone. Thirty injections were given in all, after which the patients felt quite well. Seen fourteen months later, they had remained free from pain. Ghetti (*Gaz. degli Osped.*, Sept. 23, 1900).

Frictions with chloral liniment proved very satisfactory. The liniment is rubbed vigorously in the painful area for ten minutes night and morning. It consists of equal parts of chloral-hydrate and olive-oil, the former being previously dissolved in the smallest possible amount of water. The mixture requires to be prepared fresh each time. Lafond Grellety (*Jour. de Méd. et de Chir. Pratiques*, Jan. 10, 1901).

Case of sciatica in which most active measures proved unavailing. A warm intrarachidean injection of 2-per-cent. aqueous solution of cocaine was then given in the fourth lumbar space, about one centimetre to the right of the median line, and proved successful. There was slight fever lasting three or four days and a patch of labial herpes, but no secondary symptoms followed. The analgesia lasted about ten to twelve hours and the sciatica did not return. Pulle (*Riforma Medica*, Feb. 22, 1901).

Intra-arachnoidal injections of cocaine tried in a case of sciatica. The patient, a man aged 35, had suffered from right-sided sciatica for eight days. Cocaine, $\frac{1}{12}$ grain, was injected into the intra-arachnoid space. After three minutes the pain ceased and the patient rose and walked about all day. Although the pain returned later, it was of a mild degree, and the patient considered himself cured. Marie and Guillain (*Gaz. Hebd. de Méd. et de Chir.*, No. 27, 1901).

As in many cases of sciatica there are abnormal adhesions existing just above the exit of the nerve from the greater sciatic foramen or at the foramen, therefore in stubborn cases of sciatica the nerve should be exposed at its exit and any existing adhesions be broken up with the finger. Roman von Baracz (*Centralb. f. Chir.*, March 1, 1902).

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Mobile.

NERVES, WOUNDS AND INJURIES OF.

Wounds of Nerves.

In civil life division of nerves is frequently met with among mechanics, as the result of machinery accidents, cuts with sharp tools, chisels, knives, etc. Brawls are common causes of such accidents, breaking of glass bottles and tumblers or suddenly thrusting the arm through a window offering ample opportunities for deep cuts involving the division of one or more nerves. In military life the nerves are frequently severed in the course of gunshot wounds, saber-cuts, bayonet-thrusts, etc.

Symptoms.—Whether the division of a nerve occur as the result of contusion, compression, or of any of the factors just enumerated, the symptoms are practically the same. There is functional disturbance, sensory and motor, in the area to which the severed nerve is distributed. The symptoms attending other injuries, —pain, shock, hæmorrhage, etc.,—however, vary greatly in intensity, and in no way correspond to the severity of the lesion present. Thus, a slight wound in which a small nerve has been divided may give rise to intense pain, great shock, loss of consciousness, etc., while a much more serious lesion, involving several nerves, may hardly give rise to any immediate symptoms, local or constitutional. The immediate signs, therefore, do not con-

vey reliable information regarding the severity of the injury or afford a clue to the extent of the lesion. The sensory or motor disturbances, the changes observed in the area of distribution, and the remote symptoms afford far more valuable *data*.

REFLEX SYMPTOMS.—Small nerves, when cut, often give rise to paresis of remote regions. Thus, a slight wound of the thigh may be attended by paralysis of the other thigh, of the arm on the opposite side, etc. All the muscular system may, in fact, be paralyzed, the result, according to Mitchell, Morehouse, and Keen, of exhaustion of nerve-centres of motion and sensation. Injuries of the ear may give rise to spasmodic cough, or traumatism on one side of the neck may cause palsy of some of the muscles of the arm and leg of the opposite side, etc. Shock and fainting in slight wounds—vaccination, for instance—may thus be produced.

MUSCULAR POWER.—Loss of muscular power is easily determined by the use of the dynamometer or, better still, the dynamograph.

The former shows the amount of power exerted by the hand upon the spring; the latter simultaneously gives a tracing of the regularity with which the muscle acts.

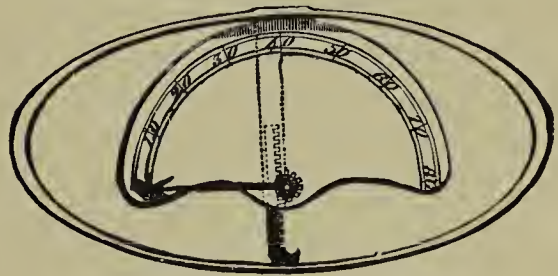
The strength of the muscles of the lower extremities can be tested by requesting the patient to jump on “tip-toe,” as suggested by Gowers. Again, the strength of the various muscles may be ascertained by causing the patient to perform some special movement bringing the suspected muscle into use.

Loss of muscular power is, obviously, a valuable diagnostic symptom if it is not merely ephemeral (a blow, pressure, etc., causing temporary paralysis of motion) and is sustained by the other signs indi-

cating loss of nervous function, deficient nutrition, and impaired electrical reaction. (See **PATHOLOGY**.)

LOCAL TEMPERATURE.—The area to which the branches of the severed nerves are distributed is often unduly cold. Indeed, this hypothermia has reached to 81° F., a difference of seventeen degrees from the normal (Kraussold and Rohden). As a rule, the local temperature varies from 96° to 93° F. Occasionally, however, the temperature is higher than normally, the excess ranging from 1° to 9° F.

SENSATION.—The skin over the area to which the cut nerves are distributed may be anæsthetic or hyperæsthetic. In the latter case the patient complains of a



Mathieu's dynamometer.

sensation of formication, pricking, or pain. The suffering is sometimes intense, a violent burning pain causing the patient to resort to various means of relief: allowing cold water to run upon the part, filling his shoes with cold water if the lesion be one involving the foot, etc.

Although complete division of a sensory nerve is likely to cause definite loss of sensation, the latter may continue nevertheless, owing probably to nerve-anastomosis. A long section of the musculo-spiral may, for instance, be removed without causing loss of sensation corresponding to the radial (Moullin). The fact that after some time the area of anæsthesia sometimes becomes smaller also suggests that collateral branches are developed or that the neighboring nerves,

acting vicariously for the trunks which are divided, are able to extend their sphere of influence. Again, one region may be absolutely anæsthetic, while an area immediately adjoining may be much less or irregularly so.

To determine the exact degree of sensitiveness present, the patient should be blindfolded and the gentlest means should be employed. A feather may be used, or, when there are hairs on the surface, delicate stroking of these will often be sufficient. A pair of compasses and a foot-rule offer ready means when hyperæsthesia is not present. Comparison between corresponding areas on both legs, or both arms, or both sides of the trunk, taking care that the same conditions are observed, will then indicate to what degree the areas of the affected part differ from the corresponding ones. The condition of the temperature sense may be determined by applying to the skin mops thoroughly soaked in water of a known temperature or dipping the extremities in the latter, or alternately in hot or cold water.

CUTANEOUS SYMPTOMS.—The skin usually appears congested and red, but it may be bluish red, very pale, or œdematous. It is usually dry, but a contrary condition sometimes prevails, drops of perspiration, giving off an unpleasant odor, covering the entire field involved. The nails may assume a curved, turtle-shell-like shape, become furrowed, and undergo ulceration. This destructive process may involve the phalanges and end in gangrene of the finger-tips. Periostitis sometimes occurs. Various cutaneous affections, eczema, herpes zoster, pemphigus, etc., are also observed.

JOINTS.—The joints are occasionally involved secondarily, arthritis developing as the result of injury, not only of the nervous supply of the limb, but also,

at times, of lesions of the cerebro-spinal system. These arthropathies so simulate acute rheumatism sometimes as to suggest the actual presence of the latter disease. Effusions into the joint, adhesive inflammation ending in ankylosis, dislocations of the articular surfaces, and even destruction of the entire joint have been noted.

WASTING.—As soon as the nutrition of the muscles is impaired through solution of continuity of their nervous supply, marked evidences of wasting soon appear. Atrophy following division of a nerve is of the most pronounced kind; the muscular structure, after a period of connective-tissue proliferation, completely disappears, leaving a mass of hard, fibrous tissue in its stead. The process of degeneration is accompanied by gradual contracture, the effects of which are deforming in proportion as the insertions of the affected muscles are far from the trunk. The hands often suffer in this connection, their usefulness being totally destroyed in some cases. The differential reactions shown by affected muscles when the electrical current is applied to them are very important; they are considered under **PATHOLOGY**.

Pathology.—When a nerve is severed, it begins to degenerate, the process following the direction of the nerve-current. If a motor nerve be cut, the degeneration will proceed in the same direction as motor impulses; these radiating from the spinal cord outwardly, it will extend from the point of section toward the periphery, while, if a sensory nerve be severed, the degeneration will advance toward the spinal cord. Proceeding with rapidity, the destruction is sometimes completed within a few weeks. The entire peripheral segment, in the case of a motor nerve, becomes fatty and granular and its myelin and eventually

its axis-cylinder undergo disintegration. In the case of sensory nerves, the process may extend into the spinal cord and even into the brain.

Changes occurring in nerve-cells after resection of their axis-cylinders are divided into three phases: Reaction, repair, and degeneration. Reaction is characterized by solution of the chromophilic bodies and dislocation of the nucleus. During repair the body of the cell swells and the nucleus returns to its normal position. The hypertrophy reaches its maximum in about ninety days, and the cells appear perfectly normal, excepting that they are somewhat darker than usual. In the course of twenty days more the distinction between the normal cells and those in a state of repair has almost disappeared. When the nerve is torn out and its repair thereby prevented, the reaction-period is complete in the course of about twenty days. Then, instead of swelling and becoming pycnomorphous, the cells lose their chromophilic substance, and become smaller, and in the course of a month may have disappeared, and the others are atrophic. The protoplasm has become translucent, the nucleus smaller and deformed, and, occasionally, the achromatic substance shows alterations. A few cells are very dark in color, partly from the retention of the chromophilic substance and partly from the staining of the cell in mass. G. Marinesco (*Neurol. Centralb.*, Oct. 1, '98).

A muscle supplied by a severed motor nerve responds in a different way to the action of the galvanic current than one normally supplied. While in the latter case the cathodic (negative) closure contraction (K.Cl.C.) is more marked than the anodic (positive) closure contraction (A.Cl.C.), the opposite is the case when the nerve has been cut. In other words, the application of the negative current causes a more marked contraction than the positive current, whereas in the normal state it is the negative current that gives rise to the stronger contraction.

The former is termed the "reaction of degeneration."

PRIMARY UNION.—The subsequent course of the injury depends upon the proximity of the two ends. If they are sufficiently close, union by first intention occurs, nerve-fibres being capable of undergoing primary union in the same manner as other tissues. The process starts from the nuclei and from the protoplasm of the sheath of Schwann (Büngner). There occurs rapid proliferation of the axis-cylinder and neurilemma of the proximal nerve-fibres, and these, once brought into contact with the peripheral portion of the divided nerve, retard and finally arrest the degenerative process. As soon as the union is sufficient to afford a suitable conductor for nerve-impulses (Vanlair) the process of repair begins, and continues until the functions are restored. In a case reported by Notta all the nerves cut some distance above the elbow were thus regenerated within six months.

DELAYED UNION.—When the ends are not in apposition the pathological changes depend to a degree upon the distance between them. Even here, if the ends are not too far apart, reunion with true regeneration of the nerve-structure often occurs, the axis-cylinder and the myelin being regenerated to a more or less perfect degree. Repair may take place when the ends are an inch apart, and, doubtless, as shown by a few reported cases, even when a much greater distance exists. Schiff, for instance, witnessed complete restoration of conductivity after a piece two inches long had been excised from the vagus of a dog. Still, such a result should not be taken as a guide in practice.

After suture of nerves early return of sensation must be regarded as indicating a restored conductivity of the divided nerve. The imperfect or non-return of

motion must be taken to imply atrophy or destruction of the muscles. Microscopical examinations reported. Both central and peripheral portions of ununited nerves contain bundles of young nerve-fibres, to the sides of which spindle-shaped nuclei are attached at frequent intervals. Where the nerve-ends were united by a cicatricial segment without conductivity being restored, the segment was found to consist of a dense net-work of connective tissue containing bundles of young nerve-fibres in its meshes. Portions excised from the central ends of the nerves showed no trace of old myelin-fibres or of degenerated fibres, but were made up of bundles of young nerve-fibres, which could be seen taking origin within the old sheaths of Schwann. No evidence was found of Krause's ascending degeneration, the old axis-cylinder and myelin-sheath being destroyed in the peripheral segment in the ultimate portion of the central segment.

Young nerve-fibres are developed in the peripheral segment as well as in the end of the central segment, even while there is no connection between the two. These young nerve-fibres arise within the old sheath of Schwann from the protoplasm and nucleus of the interannular segments. The spindle cells formed from the protoplasm and nuclei of the interannular segments elongate and unite to form protoplasmic threads with the elongated nuclei attached to their sides. The central portion of the protoplasmic thread develops into the axis-cylinder, while myelin is deposited in drops in the outer portions, the protoplasm of which remains with the nucleus as the neuroblast of the new interannular segment. As long as the conductivity of the nerve is not re-established the development of the fibres proceeds only to a certain stage, and, as the new fibres three and eighteen months after division present the same characters, this stage may be regarded as a resting stage, depending, for its further development, on re-establishment of function. The cicatricial intercalary segments of a spontaneously-reunited nerve may be permeated from end to end by young fibres without re-

establishment of function if the amount of cicatricial tissue present in the mass is sufficient by its pressure to prevent the passage of impulses. Robert Kennedy (Report to the Royal Soc., Feb. 11, '97).

Prognosis.—While sensation and motion are about equally affected immediately after the injury, sensation is usually the first to return. The improvement is generally rapid when suitable conditions of repair prevail. The chances of complete recovery, however, greatly depend upon the nature of the injury and the time elapsed between the accident and the time the remedial measures are instituted. When the muscles are not completely degenerated, much can be done with persevering treatment—months and even years being sometimes required to bring about a satisfactory result. The rapidity with which degeneration begins in the nerves and the early involvement of the muscles render it imperative, therefore, that in all cases of nerve-injury active measures should be resorted to at once.

Treatment.—The treatment of a wound in which the presence of a nerve-lesion is demonstrated by characteristic symptoms does not differ from that of any other,—including strict asepsis,—but the nerve-ends should, whenever possible, be sutured.

PRIMARY SUTURE.—An analysis of 117 cases, in which immediate suture of a divided nerve had been performed, led De Forest Willard to conclude that a good prognosis, not only of sensation, but also of motion, was thus afforded. The cases showed that clean end-to-end suture and a careful freeing of the ends for some distance from cicatricial tissue afforded the best chance for a restoration of function. The best suture-material was found to be fine chromicized catgut, inserted, by means of a small, round

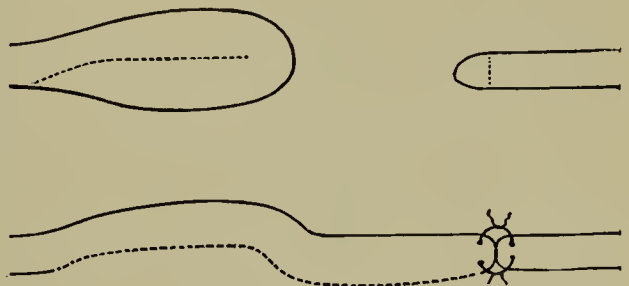
needle, directly through the body and sheath of the nerve. Two sutures crossing at right angles were usually advisable. During the healing process the part was completely at rest and the nerve relaxed when possible. Strict antisepsis is, of course, required. Stretching if the ends are not in contact may be resorted to. In 81 cases analyzed by Bowlby, 32 cases were entirely and 34 partially successful, while only 14 did not progress satisfactorily. In all such cases the reparative process is exceedingly slow, and the patient should be carefully warned of this fact.

Case in which the two ends could not be brought together without too much tension; so, after freshening the lower end, the bulbous portion of the upper end was split down the greater part of the way and sutured down to be united to the lower end, as in the figures on next page. Duncan (Clinical Jour., Dec. 21, '92).

Although correction of the evils resulting from a gap in the continuity of a nerve is a matter of great importance in a given case, it hardly seems possible at this time to say definitely what form of bridging should be employed. More cases, and especially cases recorded later and better, are needed. Neuroplasty and implantation (anastomosis) are always available resources, and for the present it would seem that they should be preferred. Resection of bone may be advisable in selected cases. Transplantation of foreign grafts should be abandoned. It is hardly necessary to say that prognosis in an individual case should always be guarded, and that repeated operations may be necessary. Charles A. Powers (Annals of Surgery, November, 1904).

SECONDARY SUTURE.—Success has also attended many cases in which nerve-suture was performed long after the injury: years in some instances. In a few, sensation, to say nothing of motion, had long disappeared. De Forest Willard also analyzed 132 cases: a sufficient

number to demonstrate that the fears of tetanus entertained some years ago were groundless and that secondary suture offered good hope of success, and should be attempted, even years after the accident. Repeated operations may ultimately succeed, and efforts to repair the results of injury should therefore be renewed. Restoration of function may take place many months after the operation, sensation returning first. Though the distal portion of a divided nerve rapidly degenerates, as does an interposed graft, transmission of function is possible and regeneration may take place both as regards sensation and motion. Strict antisepsis must prevail and the nerve well exposed,



Suture of nerves. The upper figures indicate the position before suture, the lower figure after suture. The dotted lines indicate the incision. (Duncan.)

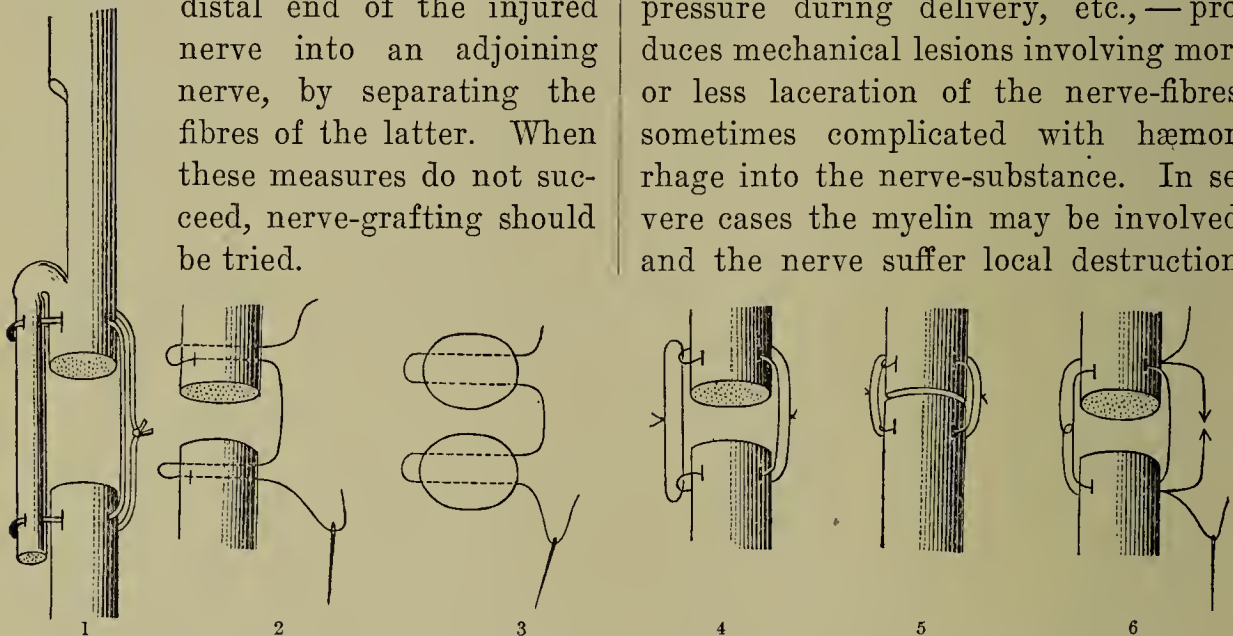
the limb being surrounded by an Es-march bandage. The bulbous proximal end is easily found, but to reach the distal end the tissues must be slit along the course of the nerve. The bulbous end is cut off and a small piece (one-quarter inch) of the distal also; the two ends are then stretched and united as in the case of immediate suture. Out of 73 cases, Bowlby's statistics only include 15 complete failures. Various methods of end-to-end suturing are shown on the following page.

In some cases the ends of the nerves cannot be brought together even in primary operations, owing to destruction of a portion of the nerve. A flap may then

be taken from the nerve, as shown in the annexed cut, and reflected over to the other end of the nerve. Return of sensation and cure in one year has been obtained from this operation, but it often fails.

Other measures proposed have been to shorten the limb by excising a piece of the bone: an operation hardly to be recommended. Better than it is the Després method, which consists in splicing the

distal end of the injured nerve into an adjoining nerve, by separating the fibres of the latter. When these measures do not succeed, nerve-grafting should be tried.



1, Nerve-suture by means of a flap. 2-6, Methods for the separation of severed nerve-ends. (*Trnka.*)

(Centralblatt für Chirurgie.)

Transplantation of a peripheral nerve-segment to bridge over a gap between the two ends of a resected nerve is a legitimate surgical procedure. Under favorable conditions at least partial, and at times complete, restoration of sensation and motion may be expected to follow the operation. Regeneration of the degenerated peripheral end is due to down-growths from the axis-cylinders of the central end. From the slowness of this process the longer the time after operation, the more favorable will be the results. Sensation may return very early after operation, and, as a rule, precedes return of motion. This rapid return of sensation is not due to down-growth of axis-cylinders or to conductivity of the transplanted fragment, but must be explained by collateral nerve-supply. In

many cases very early return of motion after transplantation may be due to vicarious movements of other muscles than those formerly paralyzed, and not to a regeneration of the latter's nerve-supply. Reuben Peterson (*Amer. Jour. of Med Sciences*, Apr., '99).

Contusion.

Contusion of a nerve, whatever its origin,—a blow, the pressure of a dislocated or fractured bone, of badly-padded crutches, malposition, forceps pressure during delivery, etc.,—produces mechanical lesions involving more or less laceration of the nerve-fibres, sometimes complicated with hæmorrhage into the nerve-substance. In severe cases the myelin may be involved, and the nerve suffer local destruction.

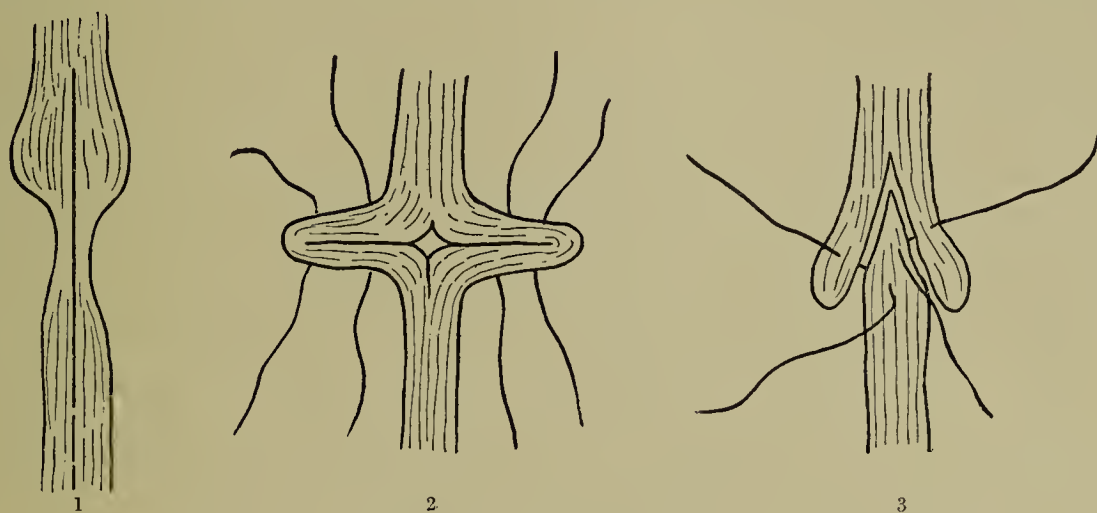
Symptoms.—The clinical signs vary greatly with the nature of the injury, the more acute symptoms often attending slight lesions, while complete destruction may not give rise to suffering. A slight blow may, for instance, momentarily suspend the conductive power, occasion quite severe pain at the seat of the injury, local heat and tingling at the peripheral ending of the nerve struck, while destructive crushing may be attended by no pain whatever, but with loss of sensation and of muscular power, followed by wasting. At times neuritis follows, with paralysis as an occasional consequence, complicated with disorders of nutrition of the cutaneous tissue, nails, etc.

The continuity of the nerve being preserved, the chances of recovery are much greater than after section, though occasionally, especially when some of the branches of the brachial plexus are bruised during falls upon the shoulder, permanent paralysis of the portion of the arm supplied by the nerve ensues. In other regions of the body, however, great injury alone will give rise to such serious sequelæ. Severe neuritis with pain in the parts to which the nerve is distributed and trophic disturbances are occasionally observed.

Diagnosis.—The extent of damage to

wasting of the region occurs, the likelihood that the nerve is torn apart by crushing is proportionately great.

Treatment.—The treatment depends upon the extent of the injury. If the latter is not severe and the faradic—though reduced—excitability persist, thorough rest of the part, splints being used for the extremities and retention bandages for the trunk, will be followed by prompt recovery. The treatment of the bruised tissues surrounding the nerves will answer all purposes. If pain be present, morphine injected hypodermically in the nearest uninjured tissues



Suture of nerves. 1, Longitudinal incision through cicatrix, extending into normal nerve-substance on either side. 2, Incision in 1 united transversely. 3, Nerve-stumps united by the wedge method. (Gleiss.)

(American Medico-Surgical Bulletin.)

the nervous supply of a contused region may usually be determined with the aid of electricity. If the muscle reacts normally to the faradic current, applied several times at intervals of about two hours, the injury is *nil* or slight. If, on the contrary, the reaction shows a tendency to become less marked or to disappear, the injury is severe, though not necessarily destructive; if it is completely interrupted or the region supplied by it gives the reaction of degeneration, the probability is that the continuity of the nerve has been interrupted; if, in addition,

may be employed. The addition of $\frac{1}{120}$ grain of atropine in the case of an adult greatly enhances the anodyne effect of the opiate. If the injury be severe and the electrical indications that the nerve has been torn are present, the treatment becomes that of incised wounds (*q. v.*), but in subcutaneous injuries the likelihood that the nerve-ends are far apart is slight and the chances of a reunion is increased in proportion. An important feature of these cases, however, is that the contusion usually involves the surrounding tissues and especially their vas-

cular supply. The vitality of the parts is correspondingly reduced. Warmth, calculated to facilitate the local circulation and nutrition, should therefore be sustained by suitable covering: cotton-wool and, if need be, hot-water or hot-sand bags.

As soon as the inflammatory stage has passed, means calculated to enhance local nutrition should be resorted to. Massage, frictions, and galvanism are the most active means at our disposal. Galvanism is more effective than faradism. Daily sittings of ten minutes each are sufficient, a weak current being employed. The parts should be thoroughly wetted to insure penetration.

Compression.

Compression, as here understood, applies to that resulting from the pressure of a tumor, an aneurism, scar-tissue, callus, etc., or an external agent such as an encysted bullet, a splinter, etc., or from pressure between a neighboring bone and an external object, as occurs frequently in persons using crutches, or when both arms are held under the head during sleep. Dislocations, especially those of the head of the humerus, often give rise to compression, while the heel of a careless surgeon's shoe when forced into the axilla during the process of reduction occasionally adds to the dangers of the occasion. Fractures of the humerus are often attended by lesions of the musculo-spiral, while fractures of the clavicle are frequently accompanied by pressure and laceration of some of the branches of the brachial plexus. In obstetrical practice the child's head is sometimes so compressed by forceps as to conduce to palsy of the seventh pair.

The symptoms and diagnostic features do not differ from those described under contusion.

Treatment.—The condition acting as

cause must first of all be removed if possible. When an extremity is the seat of trouble, this can usually be accomplished, even aneurisms being subject to cure. When a deep-seated nerve of the trunk is compressed, however, the difficulties are greatly increased and a satisfactory operation cannot always be resorted to. After removal of the cause the aim should be to encourage nutrition of the area of distribution by arsenic or strychnine, along with the electrical treatment recommended above under **CONTUSION**.

NETTLE-RASH. See **URTICARIA**.

NEURALGIA AND MIGRAINE.—

The several forms of neuralgia and headache bear a close etiological and pathological relationship to one another, being the outcome of functional or neuritic disorder of the centres or peripheral portions of the sensory cranial or spinal nerves. The differentiated varieties of these painful neuroses arise from location and function of the nerve affected, and from complicating or underlying morbid states.

Neuralgia.

Definition and Varieties.—Neuralgia is a functional or mild neuritic disorder of the sensory nerves or their centres, characterized, as the name indicates, by pain. The affection may be idiopathic—depending upon some functional disturbance alone, or it may be symptomatic—due to some organic disease of the nerve or to some disease or pathological state outside of the nervous system, such as neuritis, anæmia, and toxæmia. The tendency of later years is to diminish the number of idiopathic neuralgias by the discovery of organic disease with demonstrable pathological changes in the nerve-trunks.

Neuralgias are classified according to

their causes, as "neuritic," "toxic," "gouty," "rheumatic," etc.; or according to their location, as "trigeminal," "sciatic," "intercostal," "cervico-occipital," etc. The general features of the disorder will be first discussed, and after this the more important clinical varieties will be briefly described.

Symptoms.—Pain is the chief and characteristic symptom, the onset of the pain being sometimes preceded by soreness and stiffness in muscles and tissues of affected part, sometimes developing suddenly and without warning. The pain is intermittent or paroxysmal, of a darting, stabbing character, accompanied sometimes by burning and tingling sensations. There is usually tenderness over the entire nerve-trunk, with certain "painful points" at which the tenderness and pain is greatest. The paroxysms of pain may occur only at long intervals, but usually, for some hours, they occur every few minutes; in aggravated cases may be nearly continuous for hours or days. In occasional cases there may be some pain continuously for months or even several years. In some instances the pain is greatest at a certain time each day, the seeming periodicity being most marked in malarial cases, although seen where there can be no thought of malarial influence.

Trophic and vasomotor disturbances in affected area, such as coldness, eruptions, falling out or changes in color of the hair, etc., are occasionally seen. In some forms of neuralgia twitching or spasm of adjacent muscles accompany the paroxysms.

Numerous cases of paræsthetic neuralgia have been recorded by Roth and others, in which there is gradual development of burning pain and uneasy feelings, and sometimes anæsthesia in the antero-lateral portion of one thigh noted. The pain may be sufficient to

prevent walking. The condition has been thought to be due to compression of the external cutaneous nerve either by the psoas muscle or otherwise. Three somewhat similar cases where there was monocrural paræsthesia personally recorded. In each case the physical examination was negative. The duration of the affection varied in these cases from one month to eight years. Osler (*Jour. of Nerv. and Mental Dis.*, Mar., '97).

Diagnosis.—The diagnosis of neuralgia is simple, the presence of the characteristic pain being sufficient. The only practical difficulty is in distinguishing between neuralgia and neuritis; and here, since the conditions shade into one another, it may be impossible to draw a sharp dividing line. Generally speaking, the pain in neuritis is more constant in location than is the pain of neuralgia; it does not shift nor dart from one nerve to another; there is in neuritis much more muscular weakness, stiffness on movement, and relaxation of tissues, and absence of the history of repeated attacks.

From therapeutic point of view it is important to distinguish two classes of facial neuralgia: the first transitory and usually due to cold and peripheral irritation, the second refractory and perhaps incurable. First form: Pain during attacks is less intense, but is seldom entirely absent between them. Onset is sudden, then there is an acme and a decline. Second: *Tic douloureux* is completely paroxysmal, pain being entirely absent in intervals; its maximum intensity is reached quickly, and it ceases as suddenly as it came, the whole attack being of short duration. There may be ten to one hundred attacks in the day, which are often brought on by physiological acts or come on spontaneously. Patients compress the painful spot, and the face is contorted. Secondary vasomotor symptoms are injection of eye, œdema of eyelids, discharge from one nostril, etc. If the lingual nerve is affected the mouth fills with a copious secretion. Herpes along the

nerve is common. Most often the neuralgia lasts some time (weeks or months), and then vanishes completely for a period. However, as age advances these intervals tend to become shorter and the painful periods longer until the disease is permanent. An hysterical form can be distinguished from the true by the irregular occurrence of the attacks.

The first form of neuralgia is always benefited by analgesics (antipyrine, phenacetin, hydrobromate or valerianate of quinine); the second, or true tic, is quite uninfluenced by them. The only drug which can be relied on in the latter is opium in large doses. It may be given in pills containing 2 centigrammes of the thebaic extract of the French pharmacopœia, made freshly and not too hard. Three a day are given at first, and, the effect being carefully watched, one pill is added every other day until the desired effect is produced. This dose is continued for a few days, and then diminished by one pill every other day. Gilles de la Tourette (*Sem. Méd.*, June 24, '96).

Etiology.—Neuralgia is a disease of middle life, rarely affecting children and rarely occurring in old age. It is somewhat more frequent in women than in men; more frequent in cold than in warm weather; more frequent in cold and damp climates than in dry and warm localities. Members of neuropathic families are more liable to the disease than are persons of good nervous heredity. The immediate exciting causes are anything which lowers general nerve-tone and any toxic agent or disease attended by toxæmia, such as anæmia and general cachectic states, malaria, infectious diseases, autogenous poisonings, diabetes, lead poisoning, etc. Exposure to cold may precipitate attacks in those predisposed, as may reflex irritations from disease of eye, ovaries, abdominal organs, carious teeth, etc. Where hereditary predisposition is very strong the affection may develop without discoverable cause. The neurasthenic and hys-

terical are particularly prone to suffer from neuralgia.

In many cases of neuralgia, the true "functional" or idiopathic cases, no pathological alterations in the nerve-fibres, cells, or ganglia can be detected, the presumption being that the pain is due to malnutrition or toxæmias of a degree too slight to cause alterations of structure. In other cases the nerve-trunks are swelled and tender, and in most such cases the pathologico-anatomical changes of a mild interstitial neuritis.

Account of 15 cases of a peripheral nervous affection localized in the area of distribution of the external cutaneous nerve, name of "external paræsthetic neuralgia" being applied to these cases. The chief symptoms are pain, paræsthesia, and anæsthesia of the external aspect of the thigh. It is found chiefly among males suffering from various disturbances of the circulation (hæmorrhoids and varicose veins) and who lead a sedentary life. Symptoms believed to be due to pressure upon the nerve where it passes by the antero-superior spine. Roth (*Le Bull. Méd.*, June 8, '95).

Treatment.—The first indication is removal of the cause, when such is discoverable and can be removed. General tonic and hygienic treatment is always advisable, as any improvement in vital tone and blood-quality gives measurable relief from idiopathic neuralgia. Removal from an unhealthy climate often gives relief. Iron, arsenic, strychnine, codliver-oil, and phosphorus singly or in combination are the tonics most used. Quinine, at one time much lauded as a specific for some forms of neuralgia, is apt to prove disappointing.

A gouty temperament often underlies an attack of neuralgia. Purgatives and other measures calculated to eliminate waste-products of metabolism are often effective. Tablespoon doses of sulphate of soda every two or three hours in hot

water until purging occurs, then followed up each morning with enough to thoroughly clear the intestinal tract, and Turkish baths, remaining just long enough to start the sweating process—to arouse the activities of the skin, may be employed with appropriate remedies for the gouty diathesis proper. I. N. Love (Med. Mirror, May, '99).

The systematic use of electricity, long continued, is one of the most valuable means at our disposal for the permanent relief of neuralgic pain, the galvanic current giving best results.

Electricity affords the best means of palliating, if not curing, trifacial neuralgia. A constant current of 35 to 50 milliamperes should be used, the positive electrode being applied to the seat of pain. This electrode should have an area of two hundred to two hundred and fifty square centimetres, the negative being about double the size, to be applied over the spinal column, and each sitting to last at least fifteen minutes, or it may exceed half an hour. The positive pole should be accurately molded to the face, exactly covering the painful area. Bergonié (Arch. d'Elect. Méd., Oct. 5, '97).

Of remedies for the relief of the paroxysms of pain the coal-tar derivatives stand first. Gelsemium also is a valuable antineuralgic agent, as are ether, valerian (these last two often in combination); aconite or its active principle, aconitia; cannabis Indica, and cimicifuga. Alcohol oftentimes affords relief, but it is a dangerous remedy and should be prescribed with caution. Nitroglycerin has been found useful in cases of facial neuralgia.

If 5 to 10 drops of guaiacol are gently rubbed into the skin over the painful spot, the neuralgic pain will cease at once, no matter of what character the neuralgia may be. A. Brodnax (Wisconsin Med. Recorder, p. 228, 1900).

One-fourth, $\frac{1}{8}$, or even $\frac{1}{10}$ grain (0.015, 0.008, or 0.006 gramme) of Merck's medicinal methylene-blue, in

watery solution, hypodermically near the seat of pain or near the spinal source of the affected nerve is generally sufficient. Using these small doses two points of injection may sometimes be advisable at the same sitting. A. de Voe (Medical World, Sept., 1902).

When all other remedies fail morphia hypodermically may justifiably be used. Acupuncture, injection of water beneath the skin, and active counter-irritation may also be used with some hope of benefit. The actual cautery is quite efficacious in some instances. A strong galvanic current, sufficient to almost or quite blister the skin will frequently break up an attack completely.

For neuralgia injections of following are recommended: Osmic acid, 1; distilled water, 6; glycerin, 4 (Schapiro); to be kept in a closed bottle. Of this $\frac{1}{8}$ grain of the drug is to be used.

The needle should be inserted perpendicularly and deep into the muscles or to the bone as near as is possible to the most painful point, the overflow on the skin being prevented by a bit of cotton. When injections are made into the face, a smaller quantity should be used in order to avoid induration, which may be of a dark color. Erwin Franck (Fort-schritte der Med., Aug., '96).

Series of cases of severe neuralgia in which castor-oil brought about a speedy cure. It should be given in doses of from 1 to 2 ounces (30 to 60 grammes) three or four times daily, although in some cases good results have been obtained with smaller doses. After the first two or three doses it usually loses its cathartic effects. We should guard against its too free cathartic action by sufficient doses of opium in some form, as it is the constitutional, and not the local, effect that it is desired to produce. It is best given (after having been thoroughly washed and a few drops of some aromatic essence added) either in milk with effervescing Seltzer water or in ale, especially Bass's ale. A palatable mixture can be made by combining the oil with mucilage of acacia and lime-water. It should be thoroughly shaken before

given. It may also be given in hot lemonade. The writer extols this simple remedy, which has given results in neuralgia never obtained by other methods. F. W. Waxham (*Medical Record*, April 12, 1902).

Hydroquinone in doses of one to four grammes (15 to 60 grains) daily in these disorders proved valuable for the removal of pain in cases in which other analgesics had been used in vain. No untoward after-effects were noticed. In articular rheumatism, however, the drug proved useless. E. Meyer (*Berliner klinische Wochenschrift*, February 8, 1904).

In severe and obstinate cases the question of surgical interference may arise, the usual resources being nerve-stretching and excision of a portion of the nerve-trunk or of its ganglion. These procedures always give temporary relief or respite from pain for some months, but unless there has been total destruction of the affected sensory neurons, as by removal of the ganglion, the pain is liable to return as the nerve-fibres regenerate.

Removal of Gasserian ganglion recommended in obstinate cases of facial neuralgia. A pear-shaped flap of bone, together with the coverings of skin and muscle, the base of which is seated just above the zygomatic arch, is formed in the temporal region, the bone being divided by a circular saw, worked either by an electro-motor or by a dental engine, as shown in the illustration. This flap, still remaining attached at its base, is turned down, and the exposed dura mater is carefully detached from the bone of the middle cranial fossa and elevated, together with the brain, by a broad retractor. Next the middle meningeal artery is ligatured and the dura mater carefully detached from the bone. In this manner the Gasserian ganglion is exposed and removed. It may be adherent to the meninges, and, if great care is not taken, they may be injured or the cavernous sinus opened. If the latter happen the hæmorrhage must be arrested by packing with gauze, and further

operation desisted from. Comparison of cases operated on by Rose's method and those operated on by the method of Krause and Frank Hartley shows a mortality of 18 per cent. in the former and 9.8 in the latter. Curious functional disturbances may follow the operation. Fedor Krause (*Berliner klin. Woch.*, June 5, '95).

Thiersch's method of nerve evulsion performed on 26 patients, 52 nerves being removed for the relief of trifacial neuralgia in all but 1 case. Of the 26 patients, 17 are now free from pain, in 16 four years have elapsed since the operation. Three required further operation, and 3 out of the remaining 12 present a recurrence. Seven patients remain to-day free from pain: four years after operation. The extraction should be performed even more slowly than Thiersch recommended; twenty centimetres of nerve, including the finer twigs, may thus be removed. As a prophylactic measure, the seemingly healthy divisions of the nerve should also be removed, as the neuralgia rarely remains confined to one branch. Angerer (*Verhand. der deut. Gesell. Chir.*, xxv Congress, '96).

Relapse of the neuralgia occurs much less frequently after destruction of the ganglion than after resection of the main branches. Hitherto the results of complete extirpation have not, however, been superior to those of simple destruction of the ganglion. Of 95 recorded cases of operation 17 proved fatal, the mortality of the temporal method (Hartley-Krause and Doyen) having been about 12½ per cent., and that of Rose's method about 20½ per cent. There has been no difference in the rates of mortality attending complete and incomplete extirpation of the ganglion. Marchant and Herbet (*Rev. de Chir.*, Apr., '97).

Intracranial resection of the branches of the trigeminal nerve is not certain in its result; extirpation of the Gasserian ganglion and of the trunk of the trigeminal nerve should be preferred. This operation performed twenty-four times, always using the temporal method. Of the first patients operated on there were still living a woman aged 75, and a man

of 62, on whom the operation was performed 7½ years ago; a woman aged 76 and one of 53 operated on 6 years ago; a woman aged 42 operated on 5 years ago; and one aged 50 operated on 4 years and 3 months ago. All these patients had remained free from pain up to the present time. The advantages of the operation were so great that, notwithstanding the dangers attending it, it will keep the place it has gained. Fedor Krause (Inter. Congress of Med.; Brit. Med. Jour., Oct. 13, 1900).

The Gasserian ganglion can be safely removed by the intracranial method without ligation of the middle meningeal artery. The anterior branch of the artery lies, in the majority of cases, against the anterior lower border of the parietal bone inclosed in a bony canal. Even when it lies exposed, the hæmorrhage is rarely severe. It can then be tied. The complications attending primary ligation are thus avoided in the vast majority of cases. Julius Dollinger (Centralb. f. Chir., Nov. 3, 1900).

Conclusions regarding the treatment of trifacial neuralgia are:—

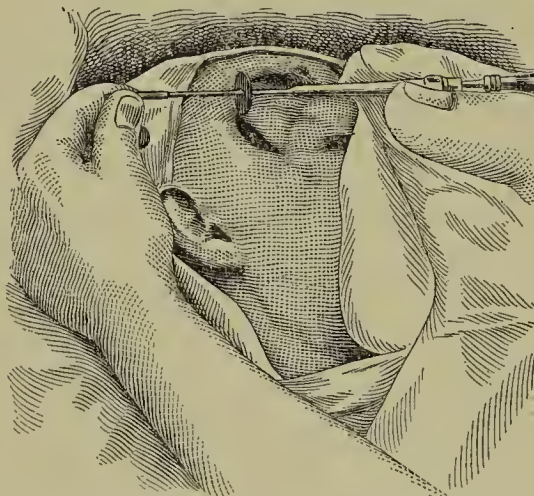
1. The essential cause of trifacial neuralgia in a given case is usually unknown, and as it may be either central or peripheral disease, or a general constitutional condition, there is apt to be a corresponding uncertainty in the treatment, especially, perhaps, in the medical measures used at the onset of the case.

2. The period of medical treatment should be distinctly limited to severe cases where the attacks succeed each other after only short intervals, and, if unsuccessful in controlling the disease, should not extend beyond six months to a year. Of course, the medical treatment will vary with the supposed character of the case, but as a routine treatment very large doses of strychnine and similar doses of the salicylates have found favor with some neurologists.

3. Operations on the peripheral nerves should still be done (in spite of the uniformity of recurrence), and are especially likely to do good when the disease is distinctly limited to either the second or the third division of the nerve, and when there is evidence to show that

there is a peripheral neuritis. In view of the atrophy of the cerebral centre which must follow the excision or destruction of a nerve-trunk, peripheral operations might still effect a cure even if the cause were central. If very thoroughly done (as by the Carnochan or Saltzer operation) the results are excellent, and although the disfigurement is about as great as after an intracranial operation, the lesser mortality will often seem to justify their performance even in bad cases.

4. In exceptionally severe cases affecting all the divisions of the nerve, with frequently recurring paroxysms, and with no immediate relief from medical treatment, the intracranial operation



Formation of flaps in Krause's operation.

may be considered as a primary operative procedure. As a rule, it should be resorted to only after failure of medical treatment and of peripheral operations.

5. The method of approach which is to be preferred is the modification of the Hartley-Krause operation elaborated by Cushing. It is reasonable to suppose that this method will aid in reducing the present mortality (20 per cent.) and in increasing the percentage of cures (90 per cent.), though the latter result must be regarded as problematical.

6. The operator may limit his interference to evulsion of the second and third divisions between the ganglion and the foramina, with the knowledge that this has been followed by cure in a number of cases. By doing so he lessens the risk of injury to the abducens nerve, and to the cavernous sinus, and, by leaving the

first (ophthalmic) division untouched, the later danger of trophic change in the eye. This course of action is favored by the knowledge that primary and exclusive disease of the first division has never been known to occur.

It is quite possible, however, that further observation will show that it is better to remove the entire ganglion with its motor and sensory roots. J. William White (Univ. of Penna. Med. Bull., Mar., 1901).

Experience in twenty-five cases in which the operation for the extirpation of the Gasserian ganglion for the relief of intractable neuralgia was performed. Relief was given in all the cases excepting one, which was not true neuralgia. Three deaths occurred, but these were due apparently to accidental causes foreign to the operation. The painful symptoms did not recur in any case, and some of the cases have been under observation for eight years.

The most noteworthy symptom was an abnormal sensation of some kind, never painful, supervening especially after intellectual strain. More or less serious lesions of the cornea were occasionally observed after operations involving the second branch of the trigeminal. Oculomotor paralyses followed in several instances, but were always of an ephemeral nature. Cerebral symptoms were noted in two or three cases. Krause (Medical Press, April 24, 1901).

Operations upon the Gasserian ganglion for tic douloureux have been carried to an unnecessary degree of severity. Resection of one-fourth or one-half inch of the nerves anterior to the ganglion and within the cranium, with the interposition of rubber tissue, can be relied upon for perfect cure, up to six years at least, with probability of permanency as great as by any other method. This is a simple, speedy, and safe method, and thereby fulfills the highest aims of the best surgery. The author advocates that in grave cases of tic douloureux the surgeon, instead of temporizing by any of the external methods of operating, should at once resort to the following method: The external carotid artery may be ligatured with advantage, as a

plan of controlling hæmorrhage. A vertical incision over the middle of the zygoma carried through the temporal muscle down to bone divides no important nerves or vessels. The muscle is scraped to either side, and held by retractors. A small opening in the skull is then made by gouge and mallet, which may be enlarged rapidly and safely to form an orifice an inch and a half in diameter. The dura is then passed away from the middle fossa until the nerves are exposed. The hæmorrhage, so much complained of, from the venous sinuses on dissecting up the periosteum, can be effectually and quickly controlled by pressing a strip of rubber tissue upon the seat of bleeding with a firm pad of gauze. The clotting of blood under the rubber tissue takes place very quickly. The nerve-trunks are grasped in separate artery clamps, and are divided each close to the foramen of and also separated either by section or forcible rotation from the Gasserian ganglion. The wound having been packed for a few moments with narrow strips of iodoform gauze, a piece one and one-half inches long and three-fourths of an inch wide, of thin gutta-percha tissue, stiff enough to be easily handled, and sterilized by rubbing with bichloride solution and subsequent immersion in salt solution laid carefully over the foramen ovale and the foramen rotundum, where the nerves have been separated, and pressed gently, but firmly, into place by iodoform gauze. In a very few moments the gauze may be drawn away and the ganglion allowed to settle down upon the rubber tissue. A small drainage tube should be placed in the lower angle of the wound for a few hours to insure a perfectly dry healing. The author asserts that it is certainly past dispute that there is no need for the removal of the first branch of the fifth pair in any case of grave tic douloureux unless the origin of the affection is to be found in a tumor of the Gasserian ganglion or behind this structure. The object of interposing rubber tissue is to place a permanent barrier to the reunion of the divided nerves. Abbe (Annals of Surg., Jan., 1903).

In even quite severe cases the pains are liable to spontaneously subside in old age, or frequently after the climacteric in women.

Neuralgia of Special Branches.

NEURALGIA OF THE FIFTH PAIR.—Neuralgia of the fifth pair of cranial nerves is also known as trifacial neuralgia, facial neuralgia, tic douloureux, etc.

Neuralgia of the fifth pair is more frequent than all other forms of neuralgia combined, and is, from a clinical standpoint, the most important of the forms of neuralgia with which the physician has to deal, this nerve seeming peculiarly susceptible to functional and organic disorders as a consequence of the complexity and highly differentiated character of its structure and connections.

All three of the branches are seldom affected simultaneously. The ophthalmic branch is that most often involved, giving rise to neuralgic pain in eye and brow ("brow-ague") with an especially painful point at the supra-orbital notch. In some cases the pain is especially intense in the eyeball. When the infra-orbital branch is involved there is the usual pain in the area of distribution of the nerve, and a marked tender point at infra-orbital foramen. A toothache-like pain in upper teeth is common. In neuralgia of the inferior dental branch the pain is often diffuse, extending from temporal region over the side of the face to the chin, with pain in lower teeth and side of the tongue, the last mentioned being, in some cases, the situation of greatest intensity. In severe forms of pain involving any branch of the fifth nerve the pain may in lesser degree extend to the other branches. In all forms of facial neuralgia trophic disorders, in particular herpes, may occur. When the pain in facial neuralgia is very intense and markedly paroxysmal, with reflex

facial muscular spasm accompanying, we have the form known as "tic douloureux": the most distressing and intractable form of nerve-pain. The general symptomatology and causation, as well as therapeutic indications of neuralgia in general apply to the facial form.

Treatment.—In treatment, improvement in general health is first to be sought.

For the relief of the acute pain opium, of course, is most reliable, but it should not be employed until aconite, coal-tar remedies, and other analgesics have been given a trial. Galvanic electricity seems especially valuable. The cataphoric administration of cocaine, chloroform, aconite, and other similar drugs gives in many cases complete and entire relief for many hours. The continued hypodermic use of strychnine at the seat of the pain has given excellent results in preventing the return of the paroxysms.

A certain number of cases of tic douloureux believed to be caused by cicatrization of the peripheral portion of the nerve. These cicatricial lesions are produced chiefly by alveolar dental periostitis, and also by the periostitis caused by eruption of the wisdom teeth. The first *desideratum* is, therefore, to cause the disappearance of the cicatrices by scraping the bone and freeing the mucous membrane of the gums. Jarre (*Med. Press and Circ.*, Sept. 13, '93).

In tic douloureux injections of strychnine are valuable made once a day, the dose being gradually increased from $\frac{1}{30}$ to $\frac{1}{6}$ or $\frac{1}{4}$ grain; ten to twenty days are required to reach this maximum. As adjuvants to the injections potassium iodide and iron, rest in bed, light diet, and diluents are to be used. Dana (*Boston Med. and Surg. Jour.*, July 2, '96).

Severe case of tic douloureux successfully treated with nitroglycerin. Tablets of $\frac{1}{100}$ grain were prescribed, at first thrice daily, gradually increased until the patient was taking seven or eight tablets daily, and, if necessary, one every

hour. The face was also treated with a mild galvanic current, and she was given a laxative tonic. She began to improve after the second week, and the improvement steadily continued.

The dose of nitroglycerin should be increased until the physiological effects are produced, even if enormous quantities must be administered. Krauss (Buffalo Med. Jour., Oct., '97).

Treatment of neuralgia of the fifth nerve is quinine in large dose four hours before attack, arsenic, and attention to nasal passages. J. J. Putnam (Med. Rec., May 9, '99).

Trifacial neuralgia, *tic douloureux*, is not the result of a pathologic entity which has so far been definitely determined. The tendency after all types of operation, with the possible exception of removal of the sensory root behind the ganglion, is to recurrence of the disease. This is probably due to the regeneration of certain nerve elements following the deep operation, and anastomosis and retention following the superficial. Sudden shocks and irritation of the terminal filaments of the trifacial not infrequently cause an immediate and occasionally a permanent cessation of the neuralgic pain. The mortality from the superficial exsection is practically *nil*; the mortality from the intracranial operations is great. The hazard is greater than should be taken in a disease which does not in itself jeopardize life. Injections of osmic acid in 1 to 2 per cent. solution into the nerve trunks relieve the pain immediately, and in a large percentage of cases for a long period of time. The injections into the superficial tissue for peripheral neuralgia should be abandoned, as the nerve trunks are easily located, and there is no danger of superficial necrosis following such operation. It should never be injected into a motor nerve or a motor nerve area, and, therefore, never into the spinal nerves, except in amputation stumps. It produces a local necrosis of the tissue into which it is injected, and even of the wall of the foramen. This necrosis does not suppurate unless the area is exposed to mouth infection. In that case the sup-

puration often continues for weeks, drainage into the mouth, giving no special inconvenience, and in no way interfering with the final result. The best results are obtained with a 1½ to 2 per cent. solution; this should be injected in many places into the nerve trunks, and also into the foramen. All of the nerve branches should be injected—the palatine, lingual, mandibular, superior maxillary (infraorbital and supraorbital). They can all be exposed through mouth incisions, except the supraorbital. Many times there are three or four divisions of the supraorbital, and they should be searched for carefully and each injected. Occasionally it is necessary to inject the auricular branch. The posterior palatine is not so difficult to inject as one would at first imagine. The foramina can and may be injected without anæsthesia or incision. The procedure is quite painful, however, and is not certain in its results. The injections can be made with local or general anæsthesia (general preferred by the author), and are free from danger. Judging theoretically from the experience with incisions, resections, and ganglion operations, the relief should not be permanent after the injection of the osmic acid. From clinical experience up to date, however, the fact is that many cases are permanently cured. Time alone must determine the final result of this treatment. J. B. Murphy (Journal American Medical Association, October 8, 1904).

CERVICO-OCCIPITAL NEURALGIA is located in first four pairs of spinal nerves, posterior branches, and is most often a result of exposure to cold or of disease of the adjacent vertebræ.

CERVICO - BRACHIAL NEURALGIA involves the sensory nerve-fibres of the brachial plexus, its common causes being cold, rheumatic disorders, or local injury. The pain is situated in the shoulder, and may extend down the arm along the course of the ulnar nerve.

Brachial neuralgia is a rare disease, and is frequently only a symptom of an organic or functional disorder of the

central nervous system or of genuine neuritis. It most often consists in pain in the arm of ill-defined character and localization of a pain of psychical or neurasthenic origin, rather than that of a genuine neuralgia. Oppenheim (Berliner klin. Woch., June 27, '98).

INTERCOSTAL NEURALGIA, involving one or more of the intercostal nerves, is, after facial neuralgia, the most frequent and important form. It is seen more often in women than in men, giving rise, when located in nerves distributed to the mammary glands, to the so-called "mammary neuralgia." The comparatively slight and fugitive pains of pleurodynia unassociated with tender points are to be regarded as neuralgic in character. Herpes zoster is seen with especial frequency in intercostal nerve-areas (see **HERPES ZOSTER**, volume iii).

Treatment.—The treatment of the intercostal form of neuralgia, as of the two preceding varieties, is that of neuralgia in general. Especially good results are obtained from counter-irritation, preferably the actual cautery.

LUMBAR NEURALGIA, involving the branches of the lumbar plexus, presents few symptoms not seen in other forms of neuralgia. The condition of "irritable testis," with pain and syncopal attacks, is probably based upon a neuralgia of the nerves of the part.

COCCYGODINIA is a neuralgia of the coccygeal plexus, most frequent, obstinate, and intractable in women, and often calling for surgical interference.

NEURALGIA OF THE SCIATIC NERVE usually assumes the form of "sciatica" (described under **PERIPHERAL NERVES**, **DISEASES OF**).

NEURALGIAS OF THE NERVES OF THE LEGS, described as crural, plantar, metatarsal, etc., present the usual features of neuralgia in general and need not here be elaborated.

Migraine.

Definition.—A form of severe paroxysmal headache, often accompanied by nausea and vomiting. Called also "hemispheres," "neuralgic headache," "sick headache," etc.

Symptoms.—Premonitory symptoms extending over a few hours to a day or two are not uncommon, these being mental hebetude, somnolence, or despondency, with vague uneasiness or ill-defined discomfort. Abnormal visual phenomena are also frequently seen prior to onset of the attack, these consisting of visual hallucinations, pupillary abnormalities, hemianopsia, and indistinctness of sight. Disturbances of other sense-mechanisms are more rare, although sometimes shown, such as anæsthetic areas about the head and face, aphonia, and transient mental disorder or confusion of ideas. Following these prodromal symptoms more or less closely, or accompanying them in quickly-developing cases, we have the characteristic headache, at first unilateral, located in the temple, eye, or occiput, but spreading as it increases in intensity until it involves all of one side of head, or in some cases both sides. The pain is intense, throbbing, and is increased by movement, noises, light, and any worry or emotional strain. Nausea is usual and vomiting frequent, becoming, in the so-called bilious headache, very distressing. This vomiting in occasional cases gives relief, its occurrence marking the end of the attack; but the usual rule is that the pain is increased and rendered more unbearable by the vomiting. The face is sometimes flushed, sometimes pale; the pulse is slow and the arteries throb and have a sclerotic feel to the touch. There is great prostration and physical weakness, and complete loss of appetite. Temperature abnormalities are some-

times present, but are neither constant nor characteristic. The urine is sometimes abundant, sometimes almost suppressed. Constipation at the beginning of the attack is the rule. The duration of the paroxysm is variable, from a few hours to several days. Twenty-four to thirty-six hours of suffering is frequent, and in the severer forms the patient may be kept in bed three or four days. The attacks recur for years, or, in rare cases, through life. In old age they usually cease; and in many women there is complete cessation after the climacteric. The seizures in women are apt to occur at or near the menstrual periods. The attacks subside slowly, as a rule. With the beginning diminution of the pain the patient falls asleep and awakes some hours later free from the pain and often feeling better than before the attack.

Close connection between migraine and other neuroses pointed out. The cortical disturbance which produces migraine may extend, and so produce other neuroses; thus hemianæsthesia, functional motor paralysis, aphasia, or alexia may result. In two cases mental disturbance was noted, in one hallucinations and loss of memory occurred immediately after an unusually severe attack of migraine, and were followed by a condition of stupor lasting thirty-six hours; gradual recovery took place. In the other, each attack was associated with maniacal symptoms lasting about an hour and a half, the patient having no remembrance of the attack when it was over. In both these cases there was typical migraine with telchopsia. Migraine is not to be regarded as a special form of epilepsy or hysteria, but either of these may succeed it. Krafft-Ebing (*Neurol. Centralb.*, Nov., '95).

Diagnosis.—The diagnosis of migraine is without especial difficulty, the presence of the characteristic headache and other clinical symptoms above mentioned being all sufficient. It is to be

remembered that neuralgia and other forms of headache may occur in a patient who suffers from migraine.

Prognosis.—Even frequent recurrence of migraine seems to have little unfavorable effect upon the general health, and life is not endangered nor probably shortened by the affection. The disease, as above said, often spontaneously subsides after middle life. Many cases are improved by treatment, in that the attacks are diminished in number and in severity, and the individual paroxysms may be aborted or quickly relieved.

A complete cure—*i.e.*, to the extent of entirely preventing recurrence of the headaches—is, however, rarely obtained by any mode of treatment yet devised. The outlook is more favorable where there is obvious, but removable, impairment of health or some removable source of reflex irritation, such as eye-strain. The most unfavorable and intractable cases are those in which strong hereditary predisposition exists.

Etiology and Pathology.—Regarding the pathology of the affection there are some differences of opinion. There are no discoverable anatomical lesions. The most tenable theory is that of Liveing: that the affection is a neurosis in whose course there occur periodical sensory discharges analogous to the motor discharges of epilepsy. It is, however, by some regarded as a neuralgic affection of the ophthalmic division of the fifth nerve, and others look upon it as a "vasomotor neurosis."

There is a regular and well-marked increase in the size of the stomach during an attack of migraine or epilepsy. The writer determined the outline of the stomach by percussion, after inflating the same when necessary, both during and after the attack, and controlled these findings by observation made during the intervals when the patient was well. This dilatation includes all parts

of the stomach, and subsides after the attack. In the course of time atony of the stomach results, followed later on by a variety of gastric and intestinal disturbances. Among 409 cases afflicted with migraine, only one presented a normal condition of the stomach, as regards this phenomenon, and in this instance the trouble had only been present a short time. Examination of a large number of patients suffering from other nervous or cerebral disorders failed to disclose this symptom, with the exception of those which were the subjects of idiopathic epilepsy. Mangelsdorf (*Berliner klin. Wochen.*, Nov. 2, 1903).

Hereditary predisposition is the most frequent and important etiological factor. Women of neurotic families are the greatest sufferers from the disease, although the affection is by no means uncommon in men. It is more common among the educated upper classes than among the laboring class. It generally makes its first appearance at or near puberty; rarely, if ever, after middle life. Overwork at school or in business, worry, lack of open-air exercise, wasting, and diathetic diseases predispose to the affection, and reflex causes are often traceable, especially disorders of the female generative organs and refractive errors and ocular muscular insufficiencies. The exciting causes immediately preceding the paroxysm are manifold and various, it being also remembered that even when there is no exciting cause the rhythmical recurrence of the seizures will not be broken. As a rule, when the usual time between attacks has nearly or quite passed, any suddenly produced nervous impression will precipitate the attack.

The common exciting causes are: indiscretions in eating, excitement, fatigue, emotional outbursts (anger, grief, etc.), loud disturbing noises, visual impressions of moving objects (as of railway-trains, passing crowds, a rapidly

moving field in microscopical work, riding backward), etc. Toothache from carious teeth and the presence in children of adenoid growths in the nasopharynx act also as immediate causes, as do gastro-intestinal disorders and leucomaine or ptomaine poisoning.

Principal causes of migraine are arthritism, the nervous diathesis, chlorosis, anæmia, and all conditions which weaken the resistance of the nervous system. Clauss (*Jour. d'Accouche.*, Sept. 2, '94).

Migraine attributed to two principal causes: (1) poisoning of gastric origin; (2) cerebral fatigue. W. Hind (*Provincial Med. Jour.*, Oct. 2, '94).

Migraine regarded as a toxæmic condition, the toxins (probably albumoses) being absorbed from the gastro-intestinal canal. In seven patients the contents of the stomach were examined during the paroxysm, and in these there was evidence of complete arrest of gastric digestion. C. E. Herter (*Jour. of Nerv. and Mental Dis.*, Jan., '97).

The occurrence in migraine of almost constant vomiting, frequent attacks of diarrhœa, and polyuria or increase in other secretions is proof that many cases of this affection depend upon intoxication. It is also probable that many attacks are due to the uric-acid diathesis. W. Stekel (*Wiener med. Woch.*, Nov. 13, '97).

Treatment.—When, as is often the case, the patient is aware of the causes which produce the paroxysms the first requisite is a rigid avoidance of these causes. In this way the number of attacks may be materially diminished, although no amount of care will altogether prevent occasional recurrences. In children the first attack of hemi-crania should suggest a careful search for ocular insufficiencies or other possible reflex cause, and in all children of neurotic families having a predisposition to migraine especial hygienic precautions, as to avoidance of eating excessively, long hours of study, etc., should be observed.

Prevention of migraine: 1. Red meats are to be rigidly excluded; fish, bacon, brains, sweetbreads, and eggs are allowed. Rich and highly-spiced dishes are to be avoided. Coffee, tea, and alcoholic beverages are to be excluded. Sweets should be reduced; but when meats are excluded a moderate amount is well borne. Water may be taken very freely. Meals to be taken at regular intervals, and overloading of the stomach to be avoided. 2. As much out-door exercise is to be taken as possible—undue fatigue to be avoided; rooms always should be well ventilated, both by day and night; and hot baths taken two or three times a week. In some cases the Turkish bath is beneficial; and in others the morning cold sponge-bath is directed. 3. The medicinal treatment aims to regulate the bowels, to promote intestinal antisepsis, and to stimulate the liver, the great organ for completing the oxidation of the products of metabolism and protecting the body from poisoning. The same end may be attained in many ways. The various salicylates are all useful. In obstinate cases an occasional mercurial is required. The best results have been obtained by the long-continued use of a formula recommended by Dr. Rachford:—

R Sodium sulphate (crystals), 120 grains.

Sodium phosphate, 30 grains.

Sodium salicylate, 10 grains.

Tincture of nux vomica, 3 drops.

Distilled water, enough to make 4 ounces.

This dose is to be taken before breakfast each morning, and is best taken in a glass of Seltzer; or, better still, the ingredients are made up in these proportions in large siphon bottles charged with carbonic acid. The proportions are variously modified in different cases. E. W. Mitchell (*Jour. Amer. Med. Assoc.*, Feb. 9, 1901).

When an attack supervenes the first requisite is absolute mental and physical rest and quiet, and this in mild cases may be sufficient to give relief within an hour or two. Usually other remedies are required.

Of drugs the most valuable are the coal-tar derivatives, singly or in combination with one another, and caffeine, sodium salicylate, guarana, ammonium chloride, bromides, chloral, cannabis Indica, and a long list of similar drugs. Antipyrine is sometimes quite effective. Acetanilid (antifebrin) has also been recommended.

When other remedies fail, hypodermic injections of morphine will usually give prompt relief. Inhalations of chloroform may also be resorted to, but are not to be used when other means of relief will suffice. The danger of the establishment of a drug habit should be constantly borne in mind, and the patient be not permitted to use opium, chloroform, or similar remedies indiscriminately nor on his own responsibility. It is also noteworthy that each case must be treated individually, and that remedy employed which experience shows to give in the particular case most relief with least subsequent harm. What will entirely and quickly cure one patient may produce absolutely no effect upon the next case; and after long use any drug is liable to partially lose its effect.

Potassium iodide used in migraine to the exclusion of all other remedies. The writer was led to its administration by the observation that a great similarity existed between migraine and cerebral syphilis, the headache of both being characterized by pain that is deep-seated, constricted, of great intensity, with nocturnal exacerbations, long durations, and relapses. There is also present raised arterial tension. The author found that in the most aggravated cases, potassium iodide in 5 to 15-grain doses, three times daily, diminished both the frequency and severity. J. R. Clemens (*Therap. Gaz.*, May 15, 1903).

Other measures than the administration of medicines also give frequent and marked relief. Of these the galvanic

current to the temples and back of neck ranks first, often breaking up an attack, and when used continuously for some weeks diminishing to a great degree the tendency to migrainous attacks. Counter-irritation to the head by the actual cautery, mustard plasters, menthol, etc., is frequently helpful, as is also a hot foot-bath. Hypnotic suggestion is used by some, but is a dangerous remedy of very questionable value.

As an initial step in treatment of migraine, washing out of the stomach with water at a temperature of not less than 105° F. recommended. The sooner that this is done after the beginning of the attack, the better are the results. After lavage, a rapidly acting aperient, such as a teaspoonful or dessertspoonful of Carlsbad salts, is given. This should be aided by a soap-and-water enema. Should the headache not be removed by these means, phenacetin (10 grains) and antifebrin (5 grains) may be given. Black coffee without sugar and citrate of caffeine are also efficacious. In the intervals between the attacks milk should constitute the proteid food of at least one meal a day, and red meat should not be allowed more than once a day. Bicycling and horseback-riding are the best forms of exercise. C. E. Herter (Jour. of Nerv. and Mental Dis., Jan., '97).

During the intervals between the paroxysms hygienic measures directed toward the improvement of the general health are indicated. The long-continued use of cannabis Indica in moderate doses, or of nitroglycerin and the bromides seemingly exerts a favorable influence over the course of this disease, and in at least some cases gives great relief by reducing the number and severity of the attacks.

From the inception to the conclusion of migrainous attack digestion is practically suspended. This condition demands the withholding of nutrients with immediate dilution and elimination of

the gastric and intestinal contents. Emesis and lavage of the stomach are efficient, but often objectionable to the patient and inconvenient to the physician. Consent is much more readily obtained for emptying the lower bowel with a soapsuds enema, followed immediately by high irrigation with large quantities of hot normal salt solution. This, with small, but oft-repeated, draughts of hot water by the mouth, continued from six to twelve hours, has given better results in treatment of migraine than any purely drug medication. Between the attacks daily and copious drinking of water will do more to lessen the severity, if not prevent recurring paroxysms, than any or all drugs with only a minimum of water ingested. J. M. Aiken (Jour. Amer. Med. Assoc., Aug. 30, 1902).

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NEURASTHENIA. — Gr. *νεῦρον*, nerve; *ἀσθένεια*, weakness.

Definition.—Functional exhaustion or debility of the tissues, especially those of the nervous system, due primarily to impaired metabolism and secondarily to autointoxication.

Symptoms.—The most prominent symptom of neurasthenia is fatigue, often varying in degree with the duration of the case, but usually excessive and persistent. The patient complains of feeling "very tired" and of being unable to do mental labor, the least concentration being followed by vertigo, headache, etc.

It is characteristic of this sense of fatigue that it is in simple and typical cases always relieved or lessened by rest, and always brought on, if absent, or made worse, if present, by exertion. This readiness of fatigue is the primary and fundamental symptoms of neurasthenia. When the fatigue sensations become exaggerated, they become painful, and are then described as aches. Dercum (Alienist and Neurol., Oct., '97).

Among the many types of neurasthenia there are at least four with fairly well-marked characters: There are those due to anxiety and mental distress; cases due to overexertion and stress; others due to beginning degeneration of the neuron and destined to go on to organic breakdown; and a fourth due to toxic causes. In this last class there seems a definite cycle of symptoms: there is headache, fullness in the head, irritable temper, lack of ability to concentrate the attention, irregular flushings; dyspeptic symptoms; regurgitation, eructation, constipation, foul and feculant stools are common. There is a definite mental cycle. From noon until 9 P.M. the patient feels better, from that time the patient gets worse until 4 A.M.; when he awakes he is extremely depressed and remains so the entire morning. At noon greater cheer comes and the cycle repeats itself. M. Allen Starr (Med. News, May 4, 1901).

The headache varies in intensity from a sensation of heaviness on the top of the head, or fullness, to a feeling compared by some patients to that which an iron band tightly constricting the head might produce. This is especially marked after intellectual labor, and often disappears after the latter ceases.

The appearance of the patient does not always denote the existence of the neurasthenic state; indeed, his general mien may suggest perfect health. In the majority of cases, however, there is pallor and an unmistakable appearance of weariness. Loss of weight and anæmia are often present, and occasionally the physical debility is so great as to keep the patient in bed.

One of the first symptoms noticeable in neurasthenia is the evident anæmia or, if not anæmia, hæmic change. In all cases of neurasthenia coming under personal observation there seems to be some hæmic disturbance, no matter whether the case has as a basis an autotoxæmia, a toxæmia as a sequel of preceding disease, or is apparently purely acquired

or is of distinctly hereditary type. Each type may have some particular prominent symptom, a sexual one or gastric one; but be the type or special symptom what it may, if the disease persists any length of time there presently appears a condition of blood fairly constant and typical of the disease. The reds may or may not be reduced in count,—at times may be even above count,—but the individual erythrocyte has undergone a change so that it resembles the cells in normal blood, which, for want of a better name, may be called old cells. In many cells the cytoplasm is stained. specimens seems pushed out to the periphery to such an extent that the cell becomes dumb-bell shaped instead of the normal lenticular or biscuit shape. As a result, the cells pack together closely and show a marked diminution in volume by the hæmatokrit. The oxygen-carrying capacity is lowered, and in consequence the hæmoglobin is deficient in color-test. The blood in neurasthenia then would seem to be poor in oxygen-carrying capacity, and not only this, but, owing to the poor vasomotor control, the peripheral blood at least varies much in its character. C. H. Lodor (Jour. Amer. Med. Assoc., Apr. 20, 1901).

Amnesia, general and verbal, weakness and indistinctness of speech, irritability, fretfulness, and hypochondria, sometimes reaching to melancholia and suicidal tendencies, are sometimes witnessed. Mental aberration is suggested by many petty acts which the patient in his normal state would not have perpetrated. Indeed; he may become tyrannical, envious, jealous, and even cruel. Curious perversions of mental activity are witnessed, mental pictures and various thoughts succeeding one another with rapidity, while a name, a sentence, a time, etc., will for hours and even days recur constantly to the patient's mind.

Again, he may constantly be dreading falls, especially when near an open space, such as the top of a staircase, or experience a sense of suffocation upon the

least excitement or unusual incident of every-day life. The sudden appearance of a stranger or any unusual incident of daily life may thus excite intense fear and give rise to dangerous manifestations, especially when an organic cardiac disorder is present.

Pain along the spine accompanied by localized spinal tenderness is often complained of. Lumbago and various muscular pains suggesting rheumatism are frequent. In cases in which spinal symptoms predominate there is also marked muscular weakness,—a symptom to which Charcot attached much importance and frequently associated with tremor,—and sometimes disturbances of co-ordination, the presence of locomotor ataxia being suggested. General paresis may also be simulated; indeed, when there is a history of syphilis the differential diagnosis sometimes becomes difficult.

Many cases of dementia precox are in the early stages considered neurasthenic, but there are also abortive types of dementia precox which pass through life, or many years of it, with the dementia arrested, and are classed simply as neurasthenic. They are seen in college men and young professional men who break down suddenly after starting out brilliantly and are never heard of, becoming perhaps, bread winners and fathers and mothers of families, but never amounting to anything, and always working at a disadvantage. They have no initiative; they break down often, and have to rest and limit their work.

Finally, neurasthenia occurring under twenty is rarely neurasthenia. It is a dementia precox, or a recurrent melancholia, or the exhaustion of a phrenasthenia, and it is rarely paranoia. Neurasthenia occurring at this early period with a bad family history, including family alcoholism, should make one very suspicious of a serious malady. C. D. Dana (Boston Medical and Surgical Journal, March 31, 1904).

Hyperæsthesia of certain regions of the skin (Valleix's points) is sometimes noticed. Formications, evanescent sensations of localized heat and cold, are occasionally complained of, though these sensations may be general, as are also profuse sweating and the flushes of heat so frequently met with during the menopause.

The name neurasthenic spine is used to designate those painful affections of the spine in which the subjective symptoms are out of proportion to the objective signs and in which no organic disease can be found to exist.

The symptoms of the condition vary very much in severity, but comparatively little in type. The slightest grade is shown by backache, increased by exertion and physical or mental fatigue. Sensitive spots are present near the spinous processes in different regions of the spine. Sensitiveness of the skin and certain muscles may be present. The pain is increased by motion and jar, and, as a rule, persists for many hours after the cause of it has stopped. F. W. Lovett (Amer. Medicine, Nov. 30, 1901).

Vertigo is often complained of; in some cases it is almost continuous and characterized by exacerbations, during which the patient may fall and suffer injury. Hysterical manifestations are frequent, especially in women, though true hysteria be absent.

Irregular action of the heart, palpitation, is usually noted, the pulse sometimes being very rapid; apprehension, pain, and general distress in the cardiac region often result, increased by the least excitement, anxiety, or fit of temper. Throbbing of the arteries, including the peripheral arterioles and even at times the capillaries of the nails, may be witnessed, the veins, at times, taking part in the manifestation. Still, the extremities may be quite cold, the patient requiring heavy clothing to feel at all comfortable.

Fine muscular tremors are often observed, especially of the orbicularis oris and the lingual muscles. Short spasmodic contractions of isolated groups of muscular fibres and aimless movements of the extremities that suggest, when facial muscles are involved, chorea. The tendon-reflexes are increased in the majority of cases.

Vision is often impaired, symptoms suggesting astigmatism following any prolonged use of the eyes. The pupils sometimes appear unusually large and and often unequal, while the accommodation seems defective. Unilateral ptosis is often observed. The eyes feel weary and heavy, and letters become blurred; flashes and pain are experienced in most cases after reading even a very short time—a few minutes.

The urine is occasionally increased in quantity, but this is by no means as important a sign as some writers would have it. "Lithæmic neurasthenia" is a term applied to a form in which, besides the other symptoms enumerated, manifestations of lithæmia are marked. Phosphaturia, oxaluria, and glycosuria are frequently noted.

Series of non-traumatic cases of hysteria, hypochondria, and neurasthenia. They showed alimentary glycosuria in 14.4 per cent., as against 32.6 per cent. in traumatic neuroses, which seems to indicate that the latter occupies a position somewhat apart from other functional nervous diseases. M. Arndt (Berl. klin. Woch., Dec. 5, '98).

Sexual impotence is more or less marked and in some cases total. Seminal emissions at night and during defecation and micturition may be frequent, and depression after coitus is usually complained of. The testicles or ovaries may be extremely sensitive to pressure, a dull, heavy pain, quite persistent at times, being occasionally experienced.

Digestion is enfeebled and delayed and is associated with atonic constipation, and gastralgia is sometimes complained of. Diarrhœa, however, is noticed in a small proportion of cases.

In 333 cases analyzed, depression occurred in 22 per cent., mental confusion in 10 per cent., headache in 56 per cent., general pain in 30 per cent., insomnia in 70 per cent., myasthenia in 37 per cent., palpitation in 22 per cent., and disturbance of digestion in nearly all. The initial symptom was most frequently headache. Knee-jerk was normal, but showed a slight tendency to exaggeration (22 per cent.). In 30 per cent. of the patients there was loss of flesh. Joseph Collins and Carlin Phillips (Med. Record, Mar. 25, '99).

Gastric neurasthenia is not an affection of the stomach, pure and simple, but a local expression of a general neurasthenia, and is, in fact, the commonest manifestation of it. The patient has, in all probability, suffered for a long time with general neurasthenia of a mild form, but has taken little notice of the diminished capacity for mental and physical work, and the other characteristic symptoms, and it is not until to these are added the special gastric troubles that he decides to obtain medical advice.

As regards the recognition of gastric neurasthenia, one is practically justified in diagnosing it when we have excluded all organic or anatomical affections of the stomach, and in addition find the characteristic stigmata of general neurasthenia. The signs elicited upon a physical examination of the patient, and which will confirm the diagnosis, are the following: 1. One will probably be able to elicit the splashing sound (*clapotement*, *Magenplätschern*) during the whole of the digestive period, but the absence of food-residues from the stomach before breakfast will show that the severe form of myasthenia gastrica is absent. It is important to bear in mind that gastric plashing is absent in cases characterized by the presence of sensory neuroses only. 2. There are usually spots painful on pressure in the upper

abdominal region. There is not a single one, as in ulcer, but several, and these not so acutely tender. 3. No diagnostic information is to be obtained by the chemical examination of the gastric juice. Usually there is slight hypochlorhydria, occasionally hyperchlorhydria, and often it is quite normal. 4. Gastropptosis and nephropptosis are often present, and strongly suggest neurasthenia. The diagnosis is thus mainly to be made by a process of exclusion. George Herschell (Edinburgh Med. Jour., Jan., 1902).

Tinnitus aurium, hyperacousis, and loss of taste also occasionally attend the more prominent symptoms. Undue redness of the ears and conjunctiva are frequently observed.

Diagnosis.—Various neuroses and psychoses may readily be taken for neurasthenia when the symptoms of the latter are few and indefinite, but this is rare, and the characteristic fatigue supplemented by the main symptoms that typify the affection usually render a diagnosis easy.

HYSTERIA may be confounded with neurasthenia, but both affections may exist simultaneously in some cases. The absence of crises, contractures, among other hysterical stigmata serves to eliminate the disease as the primary one.

Attention called to the various motor disturbances in neurasthenia that may be confounded with hysteria. Tremor, the most important, exists in two-thirds of all cases, and is identical with that of exophthalmic goitre. Other motor troubles exist, though less frequently: cramps, without apparent cause; muscular weakness; rhythmical spasms of the neck, tongue, and diaphragm, and constriction of the œsophagus. Abasia may also be a symptom of neurasthenia, without any hysterical signs. Pitres (La Sem. Méd., Oct. 5, '92).

Severe (grave) hysteria without stigmata is very common; again, hysterical neurasthenia is one of the commonest varieties of this disease, and includes a

very large part of the cases that ordinarily go under the name of neurasthenia. The recognition of this is very important because of the bearing which it has upon prognosis and treatment.

While hysterical neurasthenia may be called a pseudoneurasthenia, it would be very wrong to view as hysteria all pseudoneurasthenic cases. As classification the following are suggested as different types of pseudoneurasthenia: 1. Habit-neuroses, in which the symptoms mostly represent the persistence of manifestation of previous disease long since subsided. 2. Neuroses from the pure auto-suggestion; this would include certain types of phoboneuroses. 3. Intoxications, as from gout, uræmia, improper metabolism, etc. 4. Hysterical neurasthenia. Morton Prince (Boston Med. and Surg. Jour., Dec. 29, '98).

LOCOMOTOR ATAXIA.—In neurasthenia reflex action is generally increased, while in the majority of organic affections of the nervous system, including tabes, they are diminished.

GENERAL PARESIS.—In this disease there is reduction of mental activity, while in neurasthenia the intellect is not necessarily impaired and is overactive in many cases. Mental labor is practically impossible, owing to the subsequent untoward effects. When a history of syphilis is present, however, symptoms of general paresis may supervene in addition to those typifying neurasthenia. This is particularly to be suspected when articulation is impaired or when the formation of sentences in writing becomes unusually difficult.

EXOPHTHALMIC GOITRE may also be confounded with neurasthenia, but only when there is no exophthalmos. The enlargement of the thyroid becomes the only reliable distinguishing feature, the rapid pulse, agitation, tremor, etc., being all present in neurasthenia.

Etiology.—To hereditary influence is attributed the majority of cases of neu-

rasthenia, but a more correct interpretation of the facts would probably only ascribe to heredity a predisposing influence. The disease would thus only appear on condition that factors capable of starting it prevail during the exposed individual's life. Predisposition through parental neuroses, psychoses, excesses of all kinds, particularly in sexual relations, lowers the resistance of the organism as a living entity (not only of the nervous system), and pathogenic factors find a fruitful field which, had not inherited depravity prevailed, would have proved sterile. Gout, rheumatism, syphilis, and tuberculosis may also act as predisposing conditions in the offspring.

Individuals so predisposed represent by far the majority of cases witnessed. There is another class, however, in which the ever-increasing responsibilities attending modern methods of living, unrestrained extravagance, desire to promptly acquire wealth, and the worry attending the responsibilities incurred, undermines the vital powers of the organism, and do for it what predisposition, heredity, has procured for the class first considered. If the latter are never exposed, neurasthenic symptoms never develop; if the victim of worry can so change his occupation and his mode of living before the inroad of the malady is marked, a prompt return to health usually results. In both classes the exciting conditions are similar; and sexual indiscretion, continued worry and overwork, shock accompanying injury, exposure, indiscretions in diet, improperly selected or insufficient food, and many diseases, particularly influenza, syphilis, typhoid fever, and such disorders as alcoholism, morphinism, cocaineomania, etc., will act as primary causative factors of the typical form.

Heredity is one of the most important causes of neurasthenia. Among acquired causes, the worry attending business affairs, the sequelæ of infectious diseases, especially influenza, are regarded as peculiar factors. Influenza is especially common as a forerunner of neurasthenia, occurring among physicians. Phillip Zenner (*Jour. Amer. Med. Assoc.*, May 21, '98).

In women, excessive fecundity, dysmenorrhœa, and the menopause are thought to exercise a marked exciting influence.

It is true that puberty, adolescence, the puerperium, menstruation, and the menopause are often closely related to the outbreak or to the exacerbation of many nervous and mental disorders, but the pelvic organs themselves play but a small rôle in these physiological commotions. They have to do with the whole organism of woman. Pelvic diseases in woman attended by exhausting pain may give rise to neurasthenic and hysterical states, but the influence of exhausting pain in these organs is no greater than similar exhausting pain elsewhere in the body. Disorders of the female organs which affect the nutrition of the nervous system, such as excessive hæmorrhage or suppurative processes, may also be important factors in inducing functional neurosis, though disordered blood-states brought about by pelvic disease are very infrequent as compared with disordered blood-states dependent upon disease elsewhere. Frederick Peterson (*Annals of Gyn. and Ped.*, Aug., '98).

Analysis of 333 cases: 55 per cent. were males, 45 per cent. females. The oldest patient was 67 years, the youngest 6. A large proportion of neurasthenics were Jews. The chief causes were apparently overwork (27 cases) and masturbation (26 cases). In about 50 per cent. of the cases neuropathic diathesis existed. Stigmata of degeneracy were present in 14.3 per cent. Joseph Collins and Carlin Phillips (*Med. Record*, Mar. 25, '99).

Of all these causes, those connected with the male sexual organ have been credited with the most active etiological

rôle, especially localized disorders, prostatitis, posterior urethritis, seminal vesiculitis, etc., and general disorders and habits, such as gonorrhœa and masturbation.

In neurasthenia involving the genito-urinary organs there is nothing organically wrong, although the finger in the rectum usually discloses a very sensitive condition of the prostatic region. In many of the cases the commencement of trouble is coincident with a preceding gonorrhœa. Guyon (*Ann. des Mal. des Organes Genito-urin.*, Sept., '93).

1. Neurasthenia proper can always be traced to excessive masturbation, unnatural sexual intercourse, etc. 2. Anxiety neurasthenia—distinguished by dread, restlessness, agoraphobia, vertigo in walking, sleeplessness, etc.—can also invariably be traced to sexual influences in the nature of unsatisfied impulses, *coitus interruptus*, abstinence with inflamed desires, etc. The physician is urged to assume an abnormal sexual life as his guiding star in the etiology of neurasthenia, as this alone will help him to treat it rationally, after winning his patient's confidence. Sigmund Freud (*Wien. klin. Woch.*, Nos. 2, 4, 5, and 7, '98).

Many functional derangements of the genito-urinary system, which have been called purely nervous or symptoms of neurasthenia, have as their pathological and anatomical basis a chronic or other form of prostatitis, and the so-called neurasthenia disappears as soon as this pathological condition has been cured. If these cases were only recognized early and treated properly, there would be a great diminution in the number of neurasthenic patients. A greater decrease, however, would follow the stamping out of gonorrhœa and the education of the public in the physiology of the sexual organs. Hottinger (*Corresp. f. Schweizer Aerzte*, No. 6, '97).

In most cases the active exercise of the sexual function is affected. The lesion, therefore, is to be looked for in or about the seminal vesicles and their ejaculatory ducts. In 19 of 20 consecutive cases a seminal vesiculitis, and not

neurasthenia, will prove to be responsible for the symptoms. Eugene Fuller (*Med. Rec.*, Feb. 5, '98).

Attention called to prevalence of neurasthenia among those afflicted with a posterior urethritis either with or without a stricture of large calibre. Whether it is due to the worry of the local disease or from the poisons absorbed from the urethra itself is not clear, but probably both agents are at work. In syphilis neurasthenia is by no means uncommon, especially among those who have been saturated with drugs. Indeed, the supersaturation in many cases is the causal factor. Ravogli (*Jour. Amer. Med. Assoc.*, May 21, '98).

A simple laceration of the perineum may result in profound neurasthenia that will disappear when the perineum is restored. Impaired sexual gratification in both male and female may result from laceration of the perineum, and therefrom result unhappiness and neurasthenia. In some cases the nervous condition is the result of irritation from the vermiform appendix. Coccygodynia is a condition that may give rise to nervous symptoms on account of the intimate relationship that exists between the coccyx and the ganglion impar. The fear of bearing children with the resulting efforts to induce sterility, thought to be a frequent cause of neurasthenia. Joseph Eastman (*Med. News*, June 25, '98).

Syphilis is often incriminated, but it is probable that the injudicious use of mercury is mainly responsible for the many cases traced to this cause.

Cases in which heredity play the preliminary rôle usually appear during the transition between childhood and puberty—15 to 20 years, while those in which the acquired form obtains occur during the most active period of life: *i.e.*, between 30 to 45 years.

Pathology.—Neurasthenia was until recently solely attributed to exhaustion of the nerve-centres presiding over general nutrition, and particularly of the brain. Recent researches have tended

to show, however, that the primary morbid changes exist in the organism at large. Indeed, actual loss of substance in the protoplasmic cells, especially of the nucleus, has been noted by Hodge. Impaired metabolism, with accumulation of waste-products, which in turn accumulate in the blood, gives rise to an autointoxication affecting especially the nervous system, and the functions over which the various systems preside are correspondingly impaired. This is further encouraged by the continued waste of energy from which the patient suffers if he persists in imposing even slight tasks upon his weakened organism. A vicious circle of pathogenic activity is thus formed.

The study of neurasthenia, or pathological fatigue, presents two essential conditions: 1. In normal fatigue, with the discharge of energy, the toxic products of exercise are always formed in nerve-and-muscle tissues. From this and other sources toxic elements may accumulate in the blood and tissues; in pathological fatigue these contribute to a local or general inanition and autointoxication. Visible changes in nerve-cells, attending normal fatigue, go to support the inference of a molecular and chemical variation in pathological fatigue, manifested as a condition of exhausted or changed nutritional power. These changes bear a direct relation to the etiology and pathology of neurasthenia; and habit, diathesis, and idiosyncrasy have an important influence in causing "dispositions to repeat organic processes," both normal and abnormal. Physiological chemistry gives us some knowledge of the nature of autogenous toxic substances. 2. The study of the mental elements in normal and pathological fatigue shows that the mental symptoms furnish a ready index of the "fatigue": (a) the emotional tone is either one of well-being or ill-being, and the latter, with mental depression, indicates changes in the "sense of body," or common sensations due to deficient

energy, inanition, and autointoxication; (b) special disorders of intellect and will are shown by a neurasthenic weakening of voluntary attention, or the mental power of inhibitory control, and of memory, etc. Cowles's Shattuck Lectures (Boston Med. and Surg. Jour., July 16 to Aug. 27, '91).

From the results of experiments it is believed that neurasthenia is associated with irregularities of oxidation of nitrogenous substances in the organism, and that it must therefore be classed with the other disorders due to, and associated with, disordered general metabolism. The chief cause is an intestinal autointoxication. Other predisposing causes of neurasthenia,—such as mental strain, etc.,—which may have their influence in the causation of the intestinal disorder, are not excluded.

In all cases there is a considerable diminution in urea and increase in the uric acid. The relation of the total nitrogen to the quantity of urea indicates a marked decrease in the intensity of nitrogenous oxidation. The relation of the uric acid and disodium phosphate indicates an increased secretion of uric acid. In many cases the condition of the patient improves coincidently with the diminution or disappearance of the arthritic phenomena. The changes in the urine are those characteristic of intestinal putrefaction, thus suggesting that the cause of neurasthenia is in the intestinal tract. W. von Bechterew (Neurol. Centralb., Nov. 15, '98).

Analysis of the blood in thirty-three cases of neurasthenia. Many cases showed a decreased ratio of leucocytes to erythrocytes. Nearly all had a more or less marked oligochromæmia, often with many microcytes and a few poikilocytes. T. H. Romeiser and Joseph Collins (Medicine, Nov., 1900).

Prognosis.—If the organic changes outlined have not had time to so undermine the functions of the organs secondarily involved—especially the stomach and kidneys—as to compromise their physiological functions in nutrition and elimination of waste-products, the prog-

nosis is usually favorable, provided proper prophylactic measures are strictly enforced, in conjunction with judicious treatment.

The occurrence of symptoms recalling locomotor ataxia or general paresis and impairment of articulation, though alarming, do not necessarily indicate a dangerous condition. Indeed, unless of too prolonged standing, they are sometimes the first to yield to appropriate measures.

Study of arterial tension in neurasthenia by means of the sphygmograph, showing that neurasthenic patients may be divided into three classes: (1) those in whom the vascular tension is nearly or quite normal and who quickly recover; (2) those who show a decided loss of vascular tone and who, after a course of treatment, regain a normal tension, and who usually recover in a longer or shorter time; (3) those in whom the vascular tone is very much below normal, and in whom under treatment it varies, but does not make any substantial gain. These cases do not improve much, and whatever is gained is of very doubtful permanency. Webber (Boston Med. and Surg. Jour., May 5, '98).

Treatment.—Rest, mental and physical, distractions, nutritious—though easily digested—food, and removal of baneful influences as far as possible constitute the predominant features of treatment. Physical and mental rest, however, do not imply the total cessation of activity, but a diminution of the work imposed upon the organism as a whole, preserving for it sufficient dynamic stimulation to activate all vital processes. The slight increase in the action of the heart derived from a short walk, for instance, increases the distribution of the food-products, and, as life is but the transformed energy of the food ingested, the primary factor of repair is thus assisted. Yet, undue exercise

would, by lowering the vital powers, through fatigue, bring about a contrary effect. Metabolism being deprived of a sum of energy corresponding to the excess of exertion imposed upon the organism, its activity would be reduced in proportion and all the symptoms exaggerated.

This obviously suggests that all individuals should not be treated in the same manner, and that the just merits of each individual case should be taken as a guide. An outline of the course adopted by Weir Mitchell in severe cases will serve to illustrate the general principles of treatment. "On awaking in the morning the patient is to take a cup of cocoa, after which she is to rest for twenty minutes. She is then to get out of bed and sponge herself with cool water or be sponged by an attendant, after which she is to be rubbed dry with a coarse towel. She is then to dress leisurely, and lie down for twenty minutes before breakfast; after which meal she is to lie down again for an hour, and rest absolutely. Massage should be given at 10 or 11 in the morning, and this be followed by an hour of rest. She then takes a cup of strong soup or, preferably, milk. The patient may then go about and attend to any duties until luncheon; and after this meal rest is also to be taken. During the afternoon the patient may walk or drive and attend to business matters; but she should not exercise more than she can possibly help. If electricity be used, it is best given just before the evening meal or at bed-time. The patient should retire early."

All the phases of a drugless treatment are herein represented, each of which must be regulated to suit the patient's means and his strength. Traveling is almost always useful, unless too arduous;

the changes of scene, of the varieties of food, etc., greatly tend to alter the morbid trend of the mind and to stimulate the activities of the digestive apparatus.

Isolation is recommended by many writers when neurasthenia is accompanied by very marked symptoms of lowered nutrition and muscular weakness, and when a prolonged rest in bed is insufficient to arrest the emaciation. The other factors of the treatment here are excessive feeding and rest in bed, the latter being necessary during the first six weeks of the complete treatment. The overfeeding consists especially in the progressive administration, each day, of 3, 4, 5, and 6 pints of milk in divided amounts. Occasionally, at the end of a few weeks, one or two eggs a day may be added to the milk diet.

Electricity is extolled by many writers. As to the particular current to be used, no general rule can be laid down. Rockwell and other authorities assert that static electricity, together with other forms of electricity, is not only a tonic or a sedative, but an eliminator of poisonous materials. It not only influences nervous action through the vasomotor system, but excites vital function by acting on the cell and its protoplasm, hastening nutritive changes and cellular activity; excretion is thus stimulated and poisons are eliminated—precisely the *desiderata* in neurasthenia. G. Betton Massey contends that there is a tendency to abuse of and overrate rest in the treatment of this condition, especially in cases that had previously led a sedentary existence. The treatment should, he thinks, embrace measures for arousing the defective activities of the sympathetic system of nerves as a principal feature, and he finds that strong galvanic currents to the abdomen and general galvanic stimulation are prefer-

able to the routine methods of using the faradic current now prevalent.

It is generally conceded that electricity can be left off in neurasthenia. As to the massage, it depends, of course, upon how it is done. It is almost sure to produce sound sleep if properly given in the evening to neurasthenics who have been wakeful. But if neurasthenic patients who sleep well without massage are massaged in the evening they are sure to be wakeful after it, and yet they do not feel the loss of sleep next day; they have gained something after all. Douglas Graham (Jour. Amer. Med. Assoc., Jan. 26, 1901).

Actinic rays are chemical in their quality, but of small caloric value. They exist mainly in the ultra-violet zone of the spectrum. Actinic rays derived from high-power electric lights are similar to or identical with those of solar origin. Their use is as rational as that of sunlight itself. Their value lies in their decomposing, but at the same time reconstructive molecular action on the body tissues, mainly the blood elements. By the method described by the author, their activity is enhanced by the generation of ozone in free and nascent form. Their ultimate effect is one of oxidation, and consequently they increase the metabolic changes, thereby augmenting the natural processes of regeneration within the system. The germicidal action is especially pronounced on account of the fact that few germs can exist in the presence of free or nascent oxygen in either biatomic or triatomic form. A. E. Sterne (Journal of the American Medical Association, Feb. 20, 1904).

Hydrotherapy has also been highly recommended. In cases attended with severe dyspeptic symptoms Winternitz obtains excellent results from the following procedure: The patient is placed on his back and covered with a sheet well wrung out of cold water (from the armpits to the knees). Before covering this with a dry sheet, a coil of rubber tubing is applied to the epigastrium,

through which a current of warm water at a temperature of 122° F. is passed. This procedure is employed for half an hour before each meal during a number of weeks.

The application of cold over the spine is credited with marked efficacy by Kinnear, the bags being applied from the fourth to the last lumbar vertebra.

Insomnia sometimes requires active measures, but morphine, stimulants, and all agents capable of starting a "habit" should be strictly prohibited. The bromides are also pernicious in these cases, since they tend to retard metabolism. Trional, sulphonal, amylene-hydrate, etc., have been recommended for the purpose, but the hot pack is far preferable.

Among the general remedies, strychnine still holds the first place. Beginning with $\frac{1}{60}$ grain, three times a day, the dose should gradually be increased until the physiological effects of the remedy appear. The dose should then be slightly reduced, and the weaker dose continued persistently until recovery becomes assured. The concentrated extract of *avena sativa*, a teaspoonful after meals in a glassful of water, the dose being gradually increased, is often effective.

Codeine is a sort of specific, since its good effects cannot be due to its narcotic properties, considering the small dosage. In $\frac{1}{8}$ -grain doses, given thrice daily for four to five days, and later the same amount five to six times daily, it produces most satisfactory effects. The dose can be decreased as soon as the patient feels relieved and the improvement persists under the dose reached. Otto Dornblüth (*Centralb. f. d. ges. Therap.*, xviii, No. 10, 1901).

Arsenic, iron, and other tonics are often valuable. In some cases high altitudes are beneficial, owing to the increased activity and deep breathing pro-

duced and the improved nutrition that usually follows.

Value of respiratory exercises in the treatment of this and allied nervous conditions. Successful cases reported, not only in neurasthenia, but also in Sydenham's chorea, habit chorea, hysterical tremors, and hysteria. Partial success was obtained in palsies of cerebral origin and in hysterical tremors. Failures were recorded in almost every disease for which the exercises were tried, but organic diseases of the cord and paralysis agitans were treated with appreciable improvement. Overexertion must be carefully guarded against, and the regaining of voluntary control is the fundamental principle of respiratory exercises as a remedial agent. The rhythm of the breathing should be frequently changed and only simple physical exercise combined with the respiratory. The exercise should be limited to the use of pulleys or dumbbells. J. W. McConnell (*Univ. of Penn. Medical Bulletin*, March, 1903).

All disorders, primary or secondary, should be treated, those of the digestive apparatus particularly (see STOMACH, DISEASES OF), but in the majority of cases improvement of the general health causes disappearance of complications.

It is important in this class of cases to gain the patient's confidence and to recognize his infirmities rather than persuade him that many of them are imaginary. Sympathy and consideration gain for the physician the patient's confidence and insure his co-operation in the curative measures instituted.

It is almost axiomatic that an altitude of over 2000 feet is unsuitable for the neurasthenically-disposed or convalescent patient. Any very "stimulating" climate should be avoided. Other conditions to be avoided are as follow: Districts menaced by high winds and frequent fogs; cloudy, saturated atmospheres with but slight movements of air-currents; low country (sea-level) with continuous, non-varying, although mod-

erate, heat, as where the effects of the gulf-stream is strongly felt. Thus the Bermuda Islands and Florida are enervating localities.

Ideal conditions for the neurasthenic include sea-air in a well-wooded country, far enough from the coast to avoid its fogs. A sea-voyage is, as a rule, an excellent preliminary to other climatic measures. Provided the voyage is not stormy, it acts both psychically and physically in soothing the nervous system.

In order to obtain the full benefit of correct climatic conditions the patient must have good food. Without this important adjunct the desirable climatic change may be entirely defeated in its effect on the patient. F. Savary Pearce (Med. News, Jan. 26, 1901).

The vibrations of the red rays being slower than those of other rays of the solar spectrum, they have a sedative effect upon the nervous system, and are especially adapted to conditions of hyperæsthesia such as exist in the neurasthenic, giving rise to the various neuralgias of such patients. Circulatory disturbances, depending for the most part upon the vasomotor nerves, are modified by the trophic influence of light, especially of the red rays. Finally, exposure to light-rays relieves the general depression by increasing appetite and digestion and improving the general nutrition as observed in personal cases. P. Joire (Le Nord Méd., April 15, 1902).

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NEURITIS. See NERVES, PERIPHERAL.

NIPPLES. See MAMMARY GLAND.

NITRIC ACID.—*Acidum nitricum*, U. S. P. (hydrogen nitrate, or aqua fortis), is a transparent, colorless (or of slightly-yellow tinge), fuming (white or grayish fumes), suffocating, and caustic liquid, strongly acid and volatile with heat. It should have a specific gravity of 1.414

(42° Baumé) and contains 68 per cent. of absolute acid. It is miscible in all proportions with water, and when added to alcohol decomposes it with violence. It should be kept in a dark-amber, glass-stoppered bottle, as it is decomposed by the action of light and air. It is the strongest of the mineral acids, and is usually exhibited in the dilute form.

Preparations and Doses.—*Acidum nitricum dilutum* (nitric acid, 10 per cent.), 5 to 30 minims.

Acidum nitrohydrochloricum (nitric acid, 18 per cent.; hydrochloric acid, 82 per cent.), 2 to 5 minims.

Acidum nitrohydrochloricum dilutum (nitric acid, 4 per cent.; hydrochloric acid, 18 per cent.), 10 to 20 minims.

Physiological Action.—In weak solution nitric acid slightly stimulates the tissues, but applied pure it destroys them, and is, on this account, classified as a very powerful caustic. Internally it can, of course, only be used greatly diluted, and its powers as a stimulant manifest themselves mainly upon the glandular elements of the gastro-intestinal tract. When taken internally for some time, nitric acid colors the gums as does mercury.

A very small proportion, if any, of the acid is eliminated through the kidneys; it is eliminated almost entirely through the intestines.

It is probable that nitric acid enters the blood, where it is converted into a nitrate. Some of the organic nitrates have been shown by Bradbury to stimulate the vasomotor system, the glycol-dinitrate, for instance, acting somewhat like nitroglycerin. This effect varies with the individuals, some showing comparative insusceptibility. Other nitrates act transiently as vasodilators.

Poisoning by Nitric Acid.—The symptoms of poisoning by nitric acid, in con-

centrated form, are those of an acute and violent inflammation of the digestive tract induced by the ingestion of a caustic irritant. They vary in severity and rapidity of development according to the strength and amount of the acid swallowed. The fact that when nitric acid comes in contact with organic matter it imparts to it a yellow color or stain, not easily removed, aids us in differentiating the traces of nitric acid from those of sulphuric (black eschar) or hydrochloric (white eschar) acid. Thus, we may look for yellow stains on the skin, in the mouth, and perhaps on the clothing. Great pain will be present throughout the entire digestive tract, associated with vomiting of a dark matter, resembling coffee-grounds (altered blood), and occasionally portions of mucous membrane; a feeble pulse, clammy skin, and profuse bloody salivation. Renal irritation may be severe and the urine and fæces may contain blood more or less altered. Death may occur either from the gastro-intestinal inflammation or from collapse. If recovery take place the patient may suffer from stricture of œsophagus, stomach, or bowels, or from more or less destruction of the peptic tubules.

Death from inhaling nitric-acid fumes in one of four firemen attending a fire during which they were exposed to these fumes through the breaking of a carboy. A broncho-pneumonia developed with subsequent œdema of the lungs, and death occurred twenty-nine hours later. The other firemen suffered but slightly and recovered completely in twenty-four hours. H. S. Pearse (Albany Med. Annals, Jan., '99).

Treatment of Nitric-Acid Poisoning.—There are four indications to be met: (1) to neutralize the acid through the use of alkaline solutions,—chalk magnesia, sodium or potassium carbonates, scrapings from whitewash or plastered walls, or even soap-suds; (2) to protect

mechanically the corroded and inflamed tissues, through the use of white of egg, oils, and mucilaginous drinks (flaxseed-tea, barley-water, etc.); (3) to relieve the pain, through the use of opium; (4) to counteract the depression of the vital powers, through the application of external heat, the use of stimulating and nutrient enemata, and venous injections of ammonia. If pure acid in any considerable amount has been ingested, favorable results must not be looked for. The smallest quantity of nitric acid that has produced death was two drachms. Death ensued in two hours. Fatal accidents occasionally result from inhaling the fumes of nitric acid.

Therapeutics.—When nitric acid is taken internally it should be freely diluted and be taken through a glass tube to prevent its corrosive action on the teeth. When taken continuously for too long a period it may affect the gums like mercury (salivation and spongy gums, probably due to local action), and this should be an indication for suspending its use.

INTERNAL USES.—Nitric acid has been found to benefit patients suffering from oxaluria and from dyspepsia with phosphatic urine. Its use has also been advised in lithæmia. In stomatitis with the presence of small ulcers in the mouth and over the tongue the internal administration of nitric acid in small doses is followed by good results, especially if each ulcer be touched with a 60-grain solution of nitrate of silver. Summer and colliquative diarrhœas are favorably influenced by the internal administration of nitric acid. In chronic diseases of the liver nitric acid is useful, but nitrohydrochloric acid is better, especially in mucous duodenitis and catarrh of the gall-ducts and malarial jaundice. Intestinal indigestion associated with diarrhœa

yields kindly to nitric acid; when diarrhoea is absent hydrochloric acid is to be preferred.

Chronic bronchitis and hoarseness produced by singing are said to be relieved by 10-minim doses of dilute nitric acid (Bartholow). In whooping-cough nitric acid is beneficial after the subsidence of the catarrhal stage, though some claim that it shortens the duration of the disease. Hammond, Bailey, and others have used nitric acid with success in the treatment of intermittent fever, giving it in full doses every four or six hours. It is also of great service in relieving hepatic congestion, after the paroxysm has been arrested by quinine. It is best given combined with the bitters.

LOCAL USES.—Nitric acid used locally is caustic, astringent, or stimulant according as it is used pure or diluted. Pure nitric acid is one of the most efficient and most controllable escharotics at our command. The area of action may be limited by the application of a ring of oil or of ointment, and the depth of action by the application of alkaline solution or of soapy water. It may be applied as a caustic to phagedænic ulcers, chancre, cancerum oris, and also hospital gangrene. Warts and condylomatous growths yield to its action. On inoperative cancerous growths it may be used as a palliative. Free-bleeding hæmorrhoids may be relieved by touching the tumors lightly with the pure acid, through a speculum, and mopping the parts with oil liberally after the acid application.

Its application may be rendered painless by allowing as much cocaine as the quantity of acid used will take up, to dissolve, in it.

In GYNÆCOLOGY pure nitric acid may be applied to the cervix or endometrium for the cure of cervical endometritis, granular endometrium, or of small fibroid

tumors. It is also used to arrest the hæmorrhage from the mucous membrane which occurs after the operative removal of polypi or small tumors.

In RHINOLOGY nitric acid may be used, applied in a fine wire probe lightly wrapped with cotton, to remove hypertrophy of the erectile tissue covering the middle turbinated bones. A previous application of a 4-per-cent. solution of cocaine renders the application painless. The acid should be applied lightly and only over the space covered by the probe. It may be repeated, if required, after the slough has separated and the parts healed.

The **ASTRINGENT ACTION** of nitric acid (1 to 500 parts) is appreciated when it is used to irrigate the bladder in cases of chronic cystitis, and as well when there are phosphatic deposits in the bladder. The solution should be slightly warmed before using.

Nitric acid as a **STIMULANT** (2-per-cent. solution) is useful when applied to unhealthy ulcerations and to irritated and bleeding hæmorrhoids.

Incidentally we may note the use of nitric acid as a test for detecting the presence of albumin in the urine; the methods of applying it for this purpose are given in full under **ALBUMINURIA** in volume i.

NITRITES (including **AMYL-NITRITE**).—The nitrites may be divided into two groups: the inorganic, or mineral, including the nitrites of sodium (officinal), barium, calcium, potassium, strontium, and the compound salt of cobalt and potassium; and the organic group, which contains the nitrites of methyl, ethyl, propyl, butyl, and amyl (officinal). These latter may be subdivided into primary, isoprimary, secondary, and tertiary nitrites.

Sodium nitrite occurs as colorless,

transparent, hexagonal crystals having a mildly-saline taste. It is soluble in $1\frac{1}{2}$ parts of water and slightly soluble in alcohol. It should be kept in a well-stoppered bottle.

Barium nitrite occurs as a white, crystalline powder or as colorless prisms. It is soluble in water and in alcohol.

Calcium nitrite occurs as deliquescent prisms or in yellowish masses. It is freely soluble in water.

Potassium nitrite occurs as white, amorphous, deliquescent sticks.

Strontium nitrite occurs as a white powder, soluble in water.

Cobalt and potassium nitrite (cobalt yellow) occurs as a yellow, microcrystalline powder, which is slightly soluble in water.

Ethyl-nitrite (nitrous ether) occurs as a yellowish, highly-aromatic, ethereal, inflammably, and exceedingly-volatile liquid. It is used in the form of a spirit (spirit of nitrous ether). When added to water it rapidly disintegrates, and should not be mixed before using.

Amyl-nitrite (iso-amyl-nitrite) occurs as a yellowish, transparent, very diffusive, unstable liquid, having a penetrating, fruity odor. It is soluble in chloroform, alcohol, and ether. It should be kept away from the fire and the light in a dark, well-stoppered bottle.

Preparations and Doses.—Amyl nitris, U. S. P., 2 to 4 minims by inhalation from a handkerchief or given in brandy.

Potassii nitris, $\frac{1}{4}$ to 2 grains.

Potassii cobalto-nitris, $\frac{1}{4}$ to $\frac{1}{2}$ grain.

Sodii nitris (U. S. P.), $\frac{1}{2}$ to 2 grains.

Spiritus ætheris nitrosi (U. S. P.; alcoholic solution of ethyl-nitrite), $\frac{1}{2}$ to 4 fluidrachms.

Physiological Action.—An important feature of the influence of amyl-nitrite is that upon the circulation. The effect upon the pulse begins a few seconds after

inhalation; the arterial tension is lowered to the utmost point in from 40 to 60 seconds, remains extremely low for 30 seconds, then rises suddenly, and $1\frac{1}{2}$ minutes afterward is only a little lower than it was before the inhalation. A small dose of sodium nitrite (2 grains) distinctly affects the pulse in from 2 to 3 minutes; the point of the lowest tension is reached in from 8 to 20 minutes, and any noticeable influence ceases in from 2 to 3 hours. Slowness and irregularity of the pulse, with slight intermissions, are sometimes observed, but these irregularities become less, or entirely disappear, soon after the administration of the drug. The nitrites, in very small amounts, affect the circulation. Thus, $\frac{1}{16}$ grain will produce a marked action in most people. Experimental evidence appears to have shown that under the influence of the nitrites the lungs are temporarily dilated, the work of the right heart being thus relieved to a certain extent. Again, they do not markedly influence the function of the kidneys, there being no alteration in the flow of urine, notwithstanding that the renal vessels are dilated. Neither do they exercise any noticeable influence on the temperature, except when given in toxic amounts. The organic nitrates and the nitrites possess similar properties, this being due to the probable conversion of the nitrate-molecule into the nitrite-molecule. (Leech.)

Nitrite of amyl influences the circulation, mainly by paralyzing the muscular supply, but markedly stimulates the heart in every way. This tends to induce cardiac paralysis and arrest in diastole if the administration be unduly prolonged. It also causes excitement of the motor functions and a slight paresis of the sensory processes (Kraepelin). This is followed by loss of motor activity in

cases of poisoning, and paralysis of respiratory centres. The blood is also affected, methæmoglobin being formed out of the corpuscular hæmoglobin.

Experiments on animals show that in mice sodium nitrite causes death by its action on the hæmoglobin, and not by any direct poisonous action on the tissues. A fatal dose of nitrite may be recovered from if the tissues are supplied with a sufficiency of oxygen. Very large doses of sodium nitrite (1.3 grammes per kilo of body-weight) caused death of the animal within fifty minutes, even when the animal was kept in oxygen at high pressure, the fatal result being due to the action of the drug upon the tissues. The same dose caused death in under twelve minutes, if the animal remained in the air at the ordinary pressure.

Amyl-nitrite and also isobutyl-nitrite were found to cause death even in compressed oxygen, but the time between the administration and the fatal event was five or six times the time required when the animal was in ordinary air. Amyl-nitrite causes death in air solely in virtue of the action of the nitrite group upon the hæmoglobin; in compressed oxygen death is caused by the amyl group.

Nitroglycerin in mice and rabbits is only slightly poisonous; in very large doses poisonous effects are produced from the direct action of the drug on the tissues, before any symptoms are produced by decomposition of the hæmoglobin, or nitrite formation. Compressed oxygen in no way relieved the symptoms.

Number of experiments made upon the blood-changes produced by the nitrites. These drugs convert hæmoglobin not simply into methæmoglobin, but into what appears to be a mixture of methæmoglobin and nitric-oxide hæmoglobin. This conversion is never complete in the living body; the maximum of change found at death was 91 per cent., 9 per cent. of the hæmoglobin being left unaltered; in non-lethal doses of sodium nitrite 56.5 per cent. of altered hæmoglobin was found in a rabbit, which afterwards recovered.

Amyl-nitrite converts hæmoglobin at first into a mixture of methæmoglobin and nitric-oxide hæmoglobin, but if excess of the drug is allowed to act, a further change into photomethæmoglobin occurs, and still further changes result from a more prolonged action.

In men and other animals after overdoses of sodium nitrite the cyanosis is undoubtedly due to the changes in the hæmoglobin; the other symptoms—such as palpitation, throbbing of the head, headache, nausea, and loss of muscular power—are exactly similar to those met with in cases of carbonic-oxide poisoning, and are characteristic effects of defective oxygen-supply to the tissues.

From the fact that only ten grains or even less are required to produce serious symptoms in men, it would seem that a much smaller dose per kilo of body-weight affects the blood in men than in mice and rabbits. J. Haldane, R. H. Makgill, and A. E. Mavrogordato (*Jour. of Phys.*, Mar., '97).

Poisoning by the Nitrites.—The symptoms of poisoning by amyl-nitrite are throbbing headache, flushed face, sense of heat, tumultuous heart's action, and diminished sensibility, mobility, and reflexes. Recovery has followed from a dose of 12 grammes (3 drachms). Death mainly occurs as the result of paralysis of the respiratory centres.

Treatment of Poisoning.—If the poison has been swallowed, evacuation of the stomach is desirable, providing the patient is seen soon enough. The recumbent position and an abundance of fresh air may be supplemented advantageously by the use of artificial respiration and the administration of stimulants, strychnine, ergot, and digitalis by hypodermic injection, or by the mouth if the patient can swallow.

In a case of poisoning by amyl-nitrite cocaine successfully employed as an antidote. The patient had accidentally spilled 46 minims on the bosom of her dress and had not immediately changed it. She complained of the most violent head-

ache, palpitation, dimness of vision, and yellow vision. Consciousness was retained, the gait was staggering, and the carotids pulsated violently. Fifteen and one-half minims of a 5-per-cent.-cocaine solution were injected subcutaneously, and in a few minutes the worst symptoms of the poisoning subsided, and in fifteen minutes quite disappeared. Schilling (*Med. Press and Circ.*, Nov. 29, '93).

Therapeutics.—The general therapeutic indications of the various members of this group are very similar. The choice of the remedy and the method of administration will depend upon the desired rapidity of action and permanence of effects, modified by any untoward or characteristic symptom which may follow the administration of any individual member of this group. When rapidity of action is desired, amyl-nitrite claims first place. When a prolonged effect is desired, sodium or potassium nitrite or, better, potassium cobalto-nitrite may be used. Gastric irritation occasionally follows the use of the nitrites of sodium, potassium, and ethyl. Headache more frequently follows the use of the amyl, isobutyl, and propyl compounds, and, less often, after the nitrites of sodium and ethyl. The pulse is most accelerated by the amyl-nitrites; sodium and ethyl-nitrites cause only slight acceleration. Isobutyl and secondary propyl compounds are more active in lowering the blood-pressure (Cash). Isobutyl-nitrite is more reliable than amyl-nitrite for the relief of anginal pains (Leech). Ethyl-nitrite and the officinal spirit of nitrous ether act especially on the skin and kidneys, increasing the perspiration and the secretion of the urine.

The general indications for the exhibition of the nitrites are primarily: the presence of general or local muscular spasm, and, secondarily, the presence of pain incident thereto. The nitrites are therefore valuable in various cardiac, pul-

monary, and nervous disorders attended by angiospasm and increased blood-pressure (high arterial tension).

CARDIAC DISORDERS.—In angina pectoris we note the presence of cardiac distress, associated with radiating muscular pain and increased arterial tension: a symptom-complex controlled and relieved by the exhibition of the nitrites. Amyl-nitrite is generally preferred at the time of the paroxysm; the alkaline nitrites may be used in the intervals, as their action is more prolonged.

For prompt and immediate relief to the pain of angina, or breathlessness due to vasomotor and bronchial spasm, that so often accompanies the senile heart, there are two drugs of supreme importance,—nitrite of amyl and nitroglycerin,—the latter having the most persistent action, and being, therefore, preferable. The tablets containing $\frac{1}{100}$ grain are the most convenient. One or two of these may be taken on any indication of pain or spasm, and the dose may be repeated several times a day if required. Balfour (*Edinburgh Med. Jour.*, June, '91).

[Grainger Stewart has pointed out that nitrite of amyl has a direct effect on nervous structures, and that it relieves other forms of neuralgia. Patient personally seen, however, with his countenance purple and the vessels almost bursting from overengorgement, due to the influence of nitrite of amyl, without experiencing the slightest relief to his anginal attack. Still, it is readily admitted that nitrite of amyl and its allies do relieve some anginal attacks, and to a certain extent, and in some cases, by the lowering of the vascular tension, without, however, admitting that there is a direct causal relationship between the anginal attacks and heightened arterial tension. E. N. WHITTIER and E. M. GREENE, *Assoc. Eds.*, Annual, '94.]

Sodium nitrite being stable, may replace the less stable amyl- and ethyl-nitrites. It dilates all the arterioles rapidly, and thus soon relieves the heart. Disagreeable symptoms may be overcome by prescribing it with ammonia-water or spirit of chloroform and small doses

of morphine. It is most useful in anginal affections and in irregular heart-action. To obtain most benefit from its use it should be continued some time after all symptoms have passed off. The maximum dose is 4 or at most 5 grains, and generally 1 or 2 grains are enough. Graves's disease would appear to be aggravated, and bronchitis and asthma are not benefited by its use. Gordon Sharp (*Practitioner*, May, '94).

In cardiac dyspnoea the nitrites are valuable, caution, however, should be observed not to exceed 5 minims of amyl-nitrite by inhalation where fatty degeneration is present. H. C. Wood recommends the nitrites in aortic insufficiency with excessive hypertrophy and severe frontal headache.

In syncope and cardiac failure following general anæsthesia (especially chloroform), shock, etc., amyl-nitrite by inhalation is strongly recommended by Edward Rice.

Case of girl, aged 7 years, who suddenly ceased respiration during tenotomy for squint under chloroform anæsthesia. Head and shoulders were lowered, and artificial respiration begun, but the child appeared quite dead.

Amyl-nitrite was poured on a piece of lint, and held over the nose and mouth; but for some time there was no response, so more and more nitrite was poured on the lint, till at last a sob was heard during the interval between the artificial respiratory movements. Still keeping these up, sure signs of life appeared, and the operation was concluded. G. E. Walker (*Brit. Med. Jour.*, Aug. 7, '97).

PULMONARY DISORDERS.—The use of the nitrite of amyl has been suggested for the relief of the dyspnoea of asthma and bronchitis. Its influence is, however, too short, and the amelioration is only temporary. Better results follow the use of the alkaline nitrites, since they disintegrate more slowly and their effects are, therefore, more prolonged. Their action is also less sudden. In nervous asthma,

when the attacks are periodical, the inhalation of a few drops of amyl-nitrite will be found useful at the beginning of the paroxysm, followed, if necessary, by small doses of sodium or ethyl-nitrite or nitroglycerin for more permanent effects. In uræmic dyspnoea the effects of amyl-nitrite are too transient. Bals and Broglis recommend the tertiary nitrite of amyl (not official) by inhalation in rather large doses (80 to 100 drops daily). They claim that it does not cause heat, tension, throbbing of the head, or other inconvenience, and is, moreover, an hypnotic.

Nitrite of amyl best administered in a mixture combined with glycerin, 3 minims to 1 drachm, adding 3 drachms of water, and taken at intervals in the course of an hour; it may be further diluted, if desired. Sir B. W. Richardson (*Asclepiad*, 4th Qr., '94-'95).

NERVOUS DISORDERS.—In epilepsy the inhalation of amyl-nitrite during the aura will ward off the paroxysm. In hysterical paroxysm, catalepsy, and hystero-epilepsy, the attacks may be cut short by repeated inhalations of the same remedy; it is especially useful in the emergencies of these diseases. In tetanus a severe paroxysm of muscular spasm is often present while the patient is being fed. Here the inhalation of a few drops of amyl-nitrite may avert death by relaxing the tonic spasm of the respiratory muscles. In cerebral anæmia the effects of the nitrites are beneficial, but transitory. The vertigo of seasickness may be relieved by inhaling a few drops of amyl-nitrite upon the first appearance of the nausea (A. L. Loomis). In Raynaud's disease J. T. Eskridge advises inhalations of amyl-nitrite in the stages of asphyxia and syncope; relief follows the prompt dilatation of the capillaries through the action of the remedy.

Inhalations of nitrite of amyl recommended in epilepsy before the convulsions. It may also be used in the treat-

ment of pertussis. J. P. Parkinson (Brit. Med. Jour., Sept. 14, '93).

GYNÆCOLOGICAL DISORDERS.—The reflex vasomotor disturbances of the climacteric and menstrual periods, depressed mental condition, cold hands and feet, peculiar flushings, hysterical manifestations, and at times pain are relieved by the nitrites.

Value of amyl-nitrite often verified for the relief of the peculiar flushings and depressed mental condition of the climacteric period in the female; as also for the nervous and hysterical troubles of younger women, characterized by suffocating spells, spasms, cold hands and feet, etc. In these cases the remedy may be employed internally, in doses of from $\frac{1}{1000}$ to $\frac{1}{100}$ of a drop in cold water, or in larger amounts by inhalations. Arthur Devoe (Med. Summary, Mar., '92).

Tachycardia of menopause. Solution of nitrite of amyl, 5 minims to the ounce of water, a teaspoonful every fifteen minutes until relieved. Baldwin (Brooklyn Med. Jour., Nov., '95).

NEURALGIA.—Neuralgic dysmenorrhœa, when due to muscular spasm, is promptly relieved by the inhalation of a few drops of amyl-nitrite (Mary Putnam-Jacoby). Migraine attended by angio-spasm and headache due to cerebral anæmia are relieved by amyl-nitrite inhalations.

ANTIDOTAL USES.—Rüdsky describes an interesting case of cocaine poisoning in which nitrite of amyl proved to be an efficient antidote. Several cases have since been reported. H. C. Wood advises the use of amyl-nitrite inhalations to lessen the spinal reflexes in cases of strychnine poisoning. He has demonstrated, by experiment, recovery after the administration of double the ordinary fatal dose of strychnine, through the use of amyl-nitrite as the only antidote.

Case of poisoning by cocaine in which nitrite of amyl proved to be a successful antidote. Case in which woman took 1

grain of hydrochlorate of cocaine for headache. A drachm of ipecacuanha produced no vomiting and nitrite of amyl was then resorted to, through inhalations by means of a handkerchief, this being about 40 minutes after the taking of cocaine. Almost instantly the cyanosis and pallor of the face disappeared, respiration became freer, and the pulse fuller and slower. An hour afterward a relapse occurred, but was again immediately relieved by inhalations of the nitrite of amyl. Twelve drops, in all, of the amyl-nitrite were inhaled, and for internal administration, as adjuvants, wine and infusion of black coffee were given. Recovery finally took place. Alexander P. Rüdsky (Med. Obozrenije, No. 5, '90).

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NITROBENZENE.—Nitrobenzene (nitrobenzol, essence of mirbane, oil of mirbane, artificial oil of bitter almonds) is an almost colorless oily liquid, having a very sweet taste and the odor of bitter almonds. It is used in the manufacture of perfumes and in the aniline industry. It is never used medicinally. It is of interest to the physician only on account of its poisonous properties.

Poisoning by Nitrobenzene.—The inhalation of the fumes of nitrobenzene produce a sense of weariness, headache, numbness in the head, confusion, and drowsiness. There is marked cyanosis, the lips become bluish, and, later, nearly black. Convulsions may ensue and death may follow by asphyxia. When taken internally, the appearance of the symptoms may be somewhat delayed and, in addition to the symptoms before named, the whole body may acquire a bluish color, the pupils dilate; the respiration become rapid, irregular, and shallow; the pulse become accelerated and thready, later imperceptible; the muscles completely relaxed, and consciousness may be

lost. Death has occurred after taking nine drops internally.

Treatment of Poisoning by Nitrobenzene.—If poisoning has occurred from inhalation, benefit is obtained from cold applications to the head, warmth applied to the trunk and extremities by means of hot-water bags or bottles, stimulants, hypodermics of strychnine, and the use of massage and artificial respiration. If the poison has been taken internally, the use of apomorphine or other emetics followed by lavage of the stomach and liberal doses of hydrated oxide of iron, whisky, dilute ammonia, etc., is indicated.

NITROGLYCERIN.—Nitroglycerin (glonoin, trinitrin, or glyceryl-trinitrite) is used in medicine only in diluted form. In the pure state it is a violent explosive. Two solutions are in use: a watery and an alcoholic solution. The latter only is official.

Physiological Action.—In general, its action is similar to that of the nitrites, being, however, slower but more permanent than that of amyl-nitrite, and influencing the vascular system more quickly than sodium nitrite, but with greater and more lasting headache.

Preparations and Doses.—Spiritus glonoini, U. S. P. (1-per-cent. solution in alcohol), $\frac{1}{4}$ to 1 drop.

The common practice is to begin with $\frac{1}{100}$ grain of nitroglycerin and increase this gradually as may be necessary to get the desired effect. One-half this dose has over and over again relieved the cardiac asthma or other conditions, with almost complete avoidance of the headache and other disagreeable symptoms. Satisfactory results from the use of nitroglycerin in doses of $\frac{1}{1000}$ grain have been obtained. Again, tolerance of the drug comes on rapidly, the smaller the beginning dose, the greater the chance to increase it and still keep it within reasonable limits. To combine nitroglycerin

with digitalis and other heart-tonics is unscientific and illogical. The effect of the nitrite comes on at once, while the effect of the digitalis cannot be looked for until hours later. Parker (Physician and Surgeon, May, 1900).

Poisoning by Nitroglycerin.—The symptoms of poisoning by nitroglycerin are similar to those of poisoning by the nitrites. It is interesting to note in this connection, however, that patients rapidly acquire a tolerance to this drug. G. E. Reading records a case of chronic nephritis in which, after a year of treatment, 1 drachm of a 10-per-cent. solution (6 grains of nitroglycerin) was taken daily with apparent cure of the symptoms. D. D. Stewart has reported similar cases.

The treatment of poisoning by nitroglycerin is similar to that of poisoning by the nitrites.

Therapeutics.—**CIRCULATORY DISORDERS.**—Nitroglycerin is a valuable remedy in the treatment of angina pectoris. While amyl-nitrite is generally conceded to be the best remedy for relieving a paroxysm on account of the rapidity with which it acts, nitroglycerin is preferable at other times by reason of its more permanent influence. It is always well to begin with small doses until the susceptibility of the patient is ascertained, as small doses affect some persons profoundly. Hoffman advises beginning with an hypodermic dose of $\frac{1}{120}$ to $\frac{1}{60}$ grain. When the susceptibility is ascertained, the best effects are produced by pushing the remedy to the point of tolerance. Larger doses are necessary in this disease than in almost any other spasmodic affection. Leech had to raise the dose to 20 minims of 1-per-cent. solution, and a larger dose may be required. Cardiac and pulmonary dyspnoea are relieved by nitroglycerin, but, as in the use of the nitrites, great care should be exercised if

the patient has a fatty heart. Bartholow has advised nitroglycerin in certain cases of anæmia.

Conclusions in regard to nitroglycerin are as follow: 1. It is only when dealing with arteries in which there is no more than the normal tonicity of the walls that the drug is liable to produce disagreeable effects. Under this condition it should be administered with caution and in small doses. 2. In cases of arterial tension the drug can be used more freely than has been customary among practitioners, the dose being proportioned to the degree of tension. 3. In cases of arterial tension tolerance of the drug is rapidly acquired, and by a slight increase day by day very large doses can soon be taken with safety, the constant guide being the degree of tension in the arterial wall. W. L. Armstrong (Med. News, Oct. 31, '96).

In angina pectoris nitroglycerin should be used, and its dosage should be pushed to the requirements of the case. Nitrite of amyl is preferred to meet the paroxysms. Commencing with doses of nitroglycerin of $\frac{1}{100}$ grain three times a day, they should be increased until the patient takes four or five or even more times as much three times a day—care being taken to select an active preparation, and being guided by the flushing of the face and throbbing of the head as to its activity. Osler (N. Y. Med. Jour., Nov.-Dec., '96).

The vaunted efficacy of glonoin in all cases of sudden heart-failure is based on a misunderstanding of its physiological action. Where the heart is simply tired and flagging from overwork, glonoin is of value. In pneumonia and hypostatic congestion of the lungs, where the right heart is unusually taxed, both in its capacity and in the work to be done, glonoin meets the condition. The effect, as some writer has said, is like bleeding a patient into himself, but it has this decided advantage over venesection: that the blood is left in the body for future use. In all conditions of sudden increase of arterial tension from acute or chronic disease and consequent embarrassment of the heart, glonoin will invariably

prove valuable. In heart-failure from disease of the heart-muscle or lesions of the valves the drug is contra-indicated. H. E. Lewis (Merck's Archives, May, 1901).

Frequently in acute collapse, or when cardiac weakness has reached the point of causing the pulse to become dicrotic, nitroglycerin is given at frequent intervals with the idea of diminishing the work of the heart. In acute cardiac collapse Romberg has shown that there is already vasomotor or paralysis, and that the failure is more vascular than cardiac, and nitroglycerin cannot under these circumstances relieve the condition. In the later stages of the disease, when the pulse is dicrotic, the dicrotism is due to the relaxed condition of the arteries, and the giving of nitroglycerin does not relieve the heart, but on the other hand destroys the normal control of the circulatory system. Nitroglycerin should only be given when arterial tension is relatively too high for the cardiac power, and then only to carry the patient over the immediate danger. It is not a drug that should be given continuously for any length of time. Lefevre (Medical News, Jan. 2, 1904).

RESPIRATORY DISORDERS.—Spasmodic asthma in the early stage, before any serious structural changes have taken place, is favorably influenced by nitroglycerin. The engorgement of the mucous membranes of the bronchial tubes is relieved and the tension on the organs of circulation is lessened. Hiccough, pertussis, and laryngismus stridulus are relieved by nitroglycerin. A. H. Smith recommends drop doses of a 1-per-cent. solution for threatened collapse in pneumonia.

RENAL DISORDERS.—In Bright's disease nitroglycerin lessens the arterial tension and relieves heart-strain. Here it is again best to begin with small doses and increase, as tolerance at each step is established. (Bartholow, Robson, Da Costa, *et al.*)

GASTRO-INTESTINAL DISORDERS.—Nitroglycerin is advised by Humphreys against all kinds of vomiting, except that of pregnancy and of peritonitis. Reflex vomiting is especially amenable to its favorable influence.

Seasickness is often relieved with great promptness by nitroglycerin. It will relieve the pain in gastralgia. Nitroglycerin is of especial value in the algid stage of cholera. One or two drops of a 1-per-cent. solution on the tongue dilates the peripheral blood-vessels, diminishes the blood-pressure, and relieves the heart. (Trussewitsch.)

NERVOUS DISORDERS.—In cases of hystero-epilepsy $\frac{1}{100}$ grain of nitroglycerin administered hypodermically will control the spasm. In epilepsy nitroglycerin is not so efficient to prevent the attack as amyl-nitrite. In Raynaud's disease great relief follows the administration of $\frac{1}{100}$ -grain doses of nitroglycerin three times daily. A large number of rebellious cases of sciatica have been cured through the use of nitroglycerin (Mikhalkine and Krauss).

In migraine, with blanched face, nitroglycerin is strongly indicated. In migrainous headaches, when the paroxysms are periodical, Gowers advises the administration of the remedy three times daily. In neuralgia of the trigeminal nerve due to insufficient blood-supply, nitroglycerin is a reliable remedy. In cephalalgia due to cerebral anæmia it affords prompt relief. It has also proved valuable in sciatica.

Seven cases in which nitroglycerin was used in the treatment of sciatica.

Of these seven patients, all received marked benefit from the very beginning of this mode of treatment. In the acute cases they recovered in from ten days to a month; in the chronic cases they improved notably, and gained daily.

The drug was administered in the form of a 1-per-cent. alcoholic solution, begin-

ning with the dose of 1 minim three times a day, and increasing up to 4 minims if found necessary, or in the form of tablets containing $\frac{1}{100}$ grain given three times daily. Bitter tonics, codliver-oil, etc., and other measures for improving the general conditions were also employed.

The only discomforts arising from the use of the drug were congestive headache and flushing of the face, sometimes following the first dose of the medicine, sometimes supervening only when the maximum doses were administered. To counteract these effects bromides may be given. Krauss (N. Y. Med. Jour., Feb. 29, '96).

MISCELLANEOUS DISORDERS.—The cold stage of intermittent fever may be aborted by the hypodermic administration of nitroglycerin or by the inhalation of amyl-nitrite. A few drops of a 1-per-cent. solution of nitroglycerin on the tongue is said to relieve the craving for opium (J. V. Shoemaker).

For the relief of muscular spasm, present in renal and hepatic colic, there is no more powerful remedy than nitroglycerin, and the same is true in cases of spasms of the bowels and stomach, whatever their source. The drug acts more promptly when given by the mouth than when administered hypodermically. J. H. Upshur (Va. Med. Monthly, Feb., '91).

Case of gall-stone colic promptly relieved by nitroglycerin. The use of nitroglycerin in biliary colic is suggested by its known paralyzing action on unstriated muscular tissue. Presumably it relaxes the spasm of the gall-bladder and ducts. G. L. Turnbull (Lancet, 1, p. 353, '96).

Nitroglycerin used as an hæmostatic in four cases of hæmoptysis with uniformly favorable results. L. W. Flick (Phila. Med. Jour., Feb. 12, '98).

Antidotal Uses.—In poisoning by illuminating gas nitroglycerin administered hypodermically acts as a prompt restorative. Speer records a case in which nitroglycerin was successfully used

as an antidote in morphine poisoning, 6 grains of morphine having been taken by a lad aged 17 years. An injection of $\frac{1}{50}$ grain was soon followed by an improvement in the respiration, and, in half an hour, by vomiting, after which $\frac{1}{100}$ grain was given. Two hours later the patient was out of danger.

One-fiftieth grain of nitroglycerin administered hypodermically to a girl poisoned with illuminating gas, with the happiest results. She had been exposed to the injurious effects of the gas for seven hours, and when seen was perfectly comatose and unable to swallow. W. C. Kloman (N. Y. Med. Jour., Oct. 26, '93).

NITROUS OXIDE.—Nitrous oxide (nitrogen monoxide, protoxide of nitrogen, laughinggas) is a colorless, transparent gas of neutral reaction, sweetish taste, and almost odorless. It may be made by heating ammonium nitrate in a flask or retort, which decomposes it into nitrous-oxide gas and water. To free it from any trace of acid or nitric oxide the gas should be passed through a solution of potassium hydrate, then through a solution of ferrous sulphate, and finally be left in an inverted jar over water for twenty-four hours. The gas may be liquefied by pressure: a fact that enables it to be carried about in cylinders. It is readily converted into the gaseous state when wanted by allowing it to escape into a rubber bag, the relief from pressure inducing the change of state from liquid to gas. Nitrous-oxide gas was discovered by Priestly. Its anæsthetic properties were first recognized by Sir Humphry Davy. It was first used practically by Horace Wells, a dentist of Hartford, Conn.

Physiological Action.—Hare and Cerna summarize the physiological action of nitrous-oxide gas as follows: It causes a rise of arterial pressure, followed by a fall, the rise being due to

vasomotor stimulation and the fall to vasomotor palsy. There is also marked slowing of the heart, which is believed to be due to stimulation of the inhibitory centre in the medulla oblongata. Finally, the slow pulse is changed into a very rapid one, due to vagal palsy. Experiments prove that the cause of the anæsthesia produced by this gas is due to asphyxia; for, if enough oxygen be inhaled simultaneously to equal the proportion of oxygen in ordinary air, anæsthesia does not appear. This addition of oxygen prevented the rise of arterial pressure usually produced by the gas, but did not interfere with the changes in the pulse-rate and force. For this reason it is believed that the action of the remedy upon sensation and the vasomotor system is separate from that upon the heart and its supplying nerves.

Under the administration of the gas the blood-corpuscles darken markedly, and the cyanosis is due to this and the diminution in the amount of oxygen present. There is no chemical conversion of the gas circulating in the blood. It enters the body and leaves it as nitrous oxide. The oxyhæmoglobin spectrum of the blood is unaltered. It is not an asphyxiant, for narcosis occurs *before* the oxygen is exhausted. The heart's action is influenced but little, and pulsation continues for perhaps one minute. In complete narcosis there is a change in calibre of the renal vessels to correspond with change in arterial pressure; renal secretion is rapidly lessened, and transitory albuminuria and glycosuria may occur (McCardie.)

Therapeutics.—Nitrous oxide is principally used by dentists for the painless extraction of teeth. It is also used as an anæsthetic for minor surgical operations of short duration, for opening abscesses, boils, or felons; for tenotomies; and for

reduction of fractures, dislocation, etc. It may be administered alone, mixed with air or oxygen, or alternately with either. When used pure, anæsthesia is more quickly induced. For the weak, the aged, or the very young, it is best given mixed with oxygen. Hare reports a case of death after the inhalation of the gas—not as one of death due to the direct influence of nitrous-oxide gas, but as an instance of the fact that the decided rise of arterial pressure which is produced by the administration of this drug during the period of anæsthesia may cause the rupture of a blood-vessel in persons who have a tendency to apoplexy. Yet the mortality of this anæsthetic is practically *nil*. In the United States, where it is used extensively, the mortality, according to McCardie, has been less than one in one million administrations.

In producing narcosis a semirecumbent posture should be avoided; the patient should sit upright, with his head supported on a rest connected with the chair.

In a series of two hundred and fifty consecutive cases results following administration of nitrous-oxide gas by the open method have been uniformly successful. It is erroneously stated that the admission of air interferes with the effect of the gas.

By the use of an inhaler, which is completely open at the top and into which the gas is allowed to fall by atmospheric pressure, from the end of a supply-pipe held over it, the full anæsthetic effects of the gas can be obtained. The administration of the anæsthetic may be continued for eleven minutes, without any disturbance of pulse or respiration. Neither have any subsequent ill effects been observed. George Flux (*Lancet*, Feb. 4, '99).

Nitrous Oxide and Oxygen.—Practical evidence and general results of experiments with nitrous oxide on animals have shown that it is possible to get a mixture of oxygen and nitrous oxide

which will contain sufficient oxygen to maintain for a length of time the vital function, and yet have so little oxygen that consciousness would be lost. The experiments of Wood have shown that in the dog 6 per cent. of oxygen in the nitrous oxide is probably the nearest approach to a practical anæsthetic mixture that can be made. Although theoretical evidence has suggested that nitrous oxide acts merely by shutting off oxygen from the blood, clinical evidence would seem to prove that the anæsthetic effect is preserved when oxygen is administered concomitantly and that safety is still further insured.

F. N. Hewett and others affirm that the combined use of nitrous oxide and oxygen is the safest method of anæsthetizing at present known, and the unpleasant after-effects of anæsthesia may usually be avoided when it is employed; but the anæsthesia induced is not so deep as that produced by ether or chloroform, the muscular system is not so completely relaxed, and is not always possible to prevent reflex and other movements during administration. The best results with nitrous oxide and ether have been with children and weak women. Strong, vigorous male adults, especially drinkers or excessive smokers, are bad subjects. It is important to avoid the ingestion of solids and fluids for several hours after the administration of this agent.

Nitrous-oxide anæsthesia can be maintained for long operations, with perfect safety to the patient, if it is combined with oxygen. When ordinary air is diluted with it the patient is partially asphyxiated and occasional suspension of the anæsthesia is necessary. The result is that prolonged anæsthesia with such a mixture means that it is a mere succession of asphyxiations. A mixture of nitrous oxide and 10 per cent. of oxygen produces no asphyxia, which shows that nitrous oxide has pure anæsthetic

properties. A Y-shaped pipe connected with the nose and mouth and containing a valve by which the amount of oxygen in proportion to the nitrous oxide can be accurately regulated submitted, besides a review of one hundred narcoses in which the anæsthesia lasted more than one-half hour—three more than two hours. S. O. Goldan (*Amer. Jour. Med. Sci.*, June, 1901).

The great advantage in the use of oxygen in connection with nitrous oxide is that a longer and more profound anæsthesia is obtained, free from cyanosis and anoxæmic convulsion. The anæsthetic does not have the disagreeable sweet taste and the suffocating sensation so objectionable to the patient in the first stage of pure nitrous-oxide anæsthesia. There is also an advantage in the use of oxygen with nitrous oxide over the use of air as the oxygenating agent. If an admixture of air and nitrous oxide containing more than 6 per cent. of oxygen is used, complete anæsthesia cannot be produced, because the percentage of nitrous oxide (being about 60 per cent.) is not great enough to produce the desired result. It is often necessary to increase the percentage of oxygen in a mixture of nitrous oxide and oxygen to 8, 10, or even 15 per cent. to obtain the desired freedom from asphyxial manifestations. Personal habit is to give the patient about 2 or 3 per cent. of oxygen approximately and increase to 7, 8, or 10 per cent., according as the patient requires. J. F. Stephan (*Cleveland Jour. of Med.*, Sept., 1901).

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Philadelphia.

NUCLEINS.—Nuclein is the principal proteid found in the nuclei of the cells of plants and animals or of yeast. It is an amorphous substance rich in phosphorus. On boiling with alkalies phosphoric acid is set free. Physiologically, nucleins may be said to form the chief chemical constituents of the living parts of cells. The number of kinds of nucleins is limited only by the varieties of cells.

Chemically, the nucleins are complex proteid bodies characterized especially by the large amount of phosphorus they contain. The phosphorus exists in the form of nucleinic acid, which is combined with a highly complex basic substance, the nucleinic acid of all nucleins being the same, the basic portion differing in the various nucleins. The basic substance, on decomposition, yields one or more of the xanthin bodies. The nucleins in general are insoluble in dilute acids and soluble in dilute alkalies; hence they resist peptic digestion and in this way may be separated from most other proteid bodies (Vaughan). Certain substances, histologically and functionally nucleins, do not yield any xanthin base (adenin, guanin, sarcin, xanthin) as a decomposition-product. These are called paranucleins. Some of these are the antecedents of true nucleins (Vaughan). Some nucleins are combined with albumins, forming compounds known as nucleo-albumins. When one of these bodies is submitted to peptic digestion, the albumin is converted into a peptone, and the nucleins form an insoluble precipitate (Vaughan).

The nucleins may be obtained from many sources—from yeast, casein, the nuclei of blood- and pus-corpuscles, the liver, the spleen, bone-marrow, the thyroid and thymus glands, the testicles, the brain, or any structure containing numerous cell-elements. Commercially, nuclein is generally derived from yeast-cells, and occurs as a dry powder or dissolved in a weak alkaline menstruum.

Therapeutics.—Nuclein has been used with apparent benefit in the initial stages of pulmonary tuberculosis, in septicæmia, in amygdalitis and pharyngitis, in pseudodiphtheria, and as a dressing and injection for indolent ulcers. Ferguson, of Toronto, successfully used nuclein in a

case of progressive anæmia, in the treatment of which all the other remedies used had failed.

Jacobsohn, of New York, attributes immunizing and curative properties to nuclein in cases of diphtheria, scarlet fever, and measles. The injection of a nuclein solution seemed to abort the attack and quell the complications. The dose given was 5 minims of nuclein solution. He ascribes to nuclein whatever efficiency the diphtheria antitoxins and other cognate remedies may have. Hitchcock, of Detroit, observed a case of hip-joint disease in which great improvement followed the systematic use of nuclein injections every second day. The patient ultimately recovered, and Hitchcock attributes the result "very largely, if not entirely, to the long and persistent use of nuclein."

CONTRA-INDICATIONS.—Nuclein should not be given for long periods to gouty persons, as the researches of Horbaczewski, Weintraub, and Richter show that the administration of nuclein, or of foods containing a large proportion of nuclein in their composition, increases notably the formation of the alloxuric bases the cause of the symptoms ascribed to uric acid.

NURSING AND ARTIFICIAL FEEDING.

Breast-milk.

PHYSICAL PROPERTIES.—Breast-milk is slightly bluish and opalescent; it is sweet, and has an alkaline or occasionally neutral reaction. Under the microscope are seen fat-droplets and granular matter; if milk from the colostrum-period is examined, there are also epithelial cells and leucocytes undergoing fatty degeneration, — "colostrum-corpuscles," —and the fat-droplets are found of varying sizes.

CHEMICAL COMPOSITION.—The nutritive ingredients are:—

1. *Water*, constituting from 85 to 90 per cent.

2. *Fat*, in the form of minute globules held in emulsion by the soluble proteid. If the milk stands, the fat collects at the top as cream. In a good specimen the percentage varies from 3 to 5, the average being about 4.

3. *Sugar*.—The carbohydrate of milk is lactose, or milk-sugar. Its proportion is remarkably constant: 6 to 7 per cent. during the whole nursing-period.

4. *Proteids*.—Casein and lactalbumin are the principal forms. The lactalbumin is in solution, and is the more readily digested and absorbed; its amount is about twice that of casein. The casein is in suspension, and is readily precipitated; the curd formed by adding acetic acid to breast-milk is in fine flocculi, thus differing from that of cows' milk, which comes down in dense masses. In a good specimen the proteids vary from 0.75 to 2.0 per cent., the average being about 1.25 per cent.

5. *Salts*.—The most important salts are calcium phosphate and potassium carbonate. Altogether the salts amount to about 0.2 per cent.

Analysis of ninety-four samples of human milk, all taken within the puerperal month, shows that wide variations in the several ingredients of breast-milk are met with. Greatest variation was observed in the fat; in one case its percentage reached 8.82, the lowest being 4.38. Average composition of mother's milk, according to personal analysis: Water, 88.10; fat, 3.08; sugar, 6.75; proteids, 1.87; and ash, 0.25. Some variations in fat were probably due to position of mother when milk was withdrawn; if in a prone position, cream is drawn off first. There were five deaths among forty-two children, and in each of the fatal cases the percentage of proteids in the mother's milk was high,

ranging from 2.05 to 4 per cent. In all but three cases the milk agreed when proteids exceeded 2.5 per cent. Variation in percentage of other ingredients seemed to be more easily borne. Richmond (Brit. Med. Jour., Jan. 22, '98).

Clinical Examination.—While a complete chemical analysis of the milk is desirable, this is often impossible; and the physician must depend on his own simple tests.

The QUANTITY may be estimated from the amount which can be drawn with a breast-pump; but the most reliable test is to weigh the infant before and after nursing on scales sensitive enough to record differences of half an ounce. The average result of two or three such weighings will be sufficiently definite.

The QUALITY of the milk, or, at least, *whether very rich or very poor*, can be made out by the following procedures. The specimen taken for examination should be the entire amount of milk that can be pumped from one breast.

ESTIMATION OF THE FAT.—A cylindrical glass tube, holding 10 cubic centimetres and graduated to hundredths, is filled with breast-milk and allowed to stand at ordinary room-temperature for twenty-four hours: then the percentage of cream is read off. Under such conditions the percentage of cream is to that of fat approximately as five to three; thus, 5 per cent. of cream indicates 3 per cent. of fat, etc.

ESTIMATION OF THE PROTEIDS.—So far as the proteids are concerned, it is possible to distinguish only between conditions in which they are very high and very low. The sugar and salts are present in so nearly constant proportions that their variations may be regarded as having practically no effect on the specific gravity. If, then, the fat is high, and the specific gravity is high, the proteids may be assumed to be in excess; if

the fat is low, and the specific gravity low, the proteids may be assumed to be in too small proportions.

[Simple apparatus devised by author for the clinical examination of breast-milk, consists of a lactometer and a graduated tube. The milk to be examined is either the entire specimen at a single nursing or a specimen taken as near the middle of the nursing as possible. The specific gravity is first taken; then the milk is put into the graduated tube up to the 100 line, and allowed to stand for twenty-four hours on the physician's table, at which time the amount of cream which has risen can be read off as hundredths. A good average milk has a specific gravity of about 1030, with about 8 per cent. of cream. Provided the specific gravity and the *percentage* of cream does not vary materially from these figures, it may be inferred that the amount of proteids is normal. L. EMMETT HOLT, Assoc. Ed., Annual, '93.]

BACTERIA.—No germs are found in normal human milk if the skin of the breast has been cleaned and the first drawings have been discarded. Only in case of suppurative disease of the breast or some general microbic disease does the milk in the lobules contain bacteria.

Seventy-six investigations made of milk taken from 73 different breasts of 64 persons. In only 4 cases was there a complete sterility of the milk. In 2 cases the milk from one breast was sterile, while that from the other contained germs. Honigmann (Zeit. f. Hyg., etc., May 26, '93).

The milk in the breasts of pregnant women, nursing women, and newborn children in the great majority of cases contains bacteria. With very few exceptions we have to deal with staphylococci alone, and especially with the staphylococcus albus.

The entrance of the bacteria takes place from without from the nipple; entrance by way of the blood-current is, up to this time, not proved without objection. Those germs which find their way into the gland are relatively harm-

less; they do not injure either the mother or the child. There is no mastitis without micro-organisms. Infection in mastitis results from without by way of the lymphatic vessels through skin injuries, and extends in various ways, dependent upon the kinds of germs which have gained entrance. Koestlin (*Archiv f. Gynäk.*, vol. liii, H. 2, '97).

The author conducted an investigation during the years 1901 and 1902 for the purpose of gathering facts relating to the following points: To make a comparison of the results of infant feeding in tenements in winter and summer; to determine how far such results were affected by the character of the milk used, especially its original bacterial contents, its preparation, and whether it was fed after heating or raw; to see to what extent results were modified by other factors, such as the care the infants received and the surroundings in which they lived. During cool weather neither the mortality nor the health of the infants observed in the investigation was appreciably affected by the kind of milk or by the number of bacteria which it contained. During hot weather when the resistance of the children was lowered, the kind of milk taken influenced both the amount of illness and the mortality. The effect of bacterial contamination was very marked when the milk was taken without previous heating. The number of bacteria which may accumulate before milk becomes noticeably harmful to the average infant in summer, differs with the nature of the bacteria present, the age of the milk, and the temperature at which it has been kept. Of the usual varieties, over 1,000,000 bacteria per cubic centimetre are certainly deleterious to the average infant. No special varieties of bacteria were found in unheated milk which seemed to have any special importance in relation to the summer diarrhœas of children. The number of varieties was very great, and the kinds of bacteria differed according to the locality from which the milk came. After the first twelve months of life, infants are less and less affected by the bacteria in milk derived from

healthy cattle. Since a large part of the tenement population must purchase its milk from small dealers, at a low price, everything possible should be done by health boards to improve the character of the general milk supply of cities by enforcing proper legal restrictions regarding its transportation, delivery, and sale. Of the methods of feeding now in vogue that by milk from central distributing stations unquestionably possesses the most advantages. The use, for infants, of milk delivered in sealed bottles, should be encouraged whenever this is possible. Since what is needed most is intelligent care, all possible means should be employed to educate mothers and those caring for infants in proper methods of doing this. Bad surroundings, though contributing to bad results in feeding, are not the chief factor. The observations indicate that close percentage modification of milk, although desirable in difficult cases, is not necessary to obtain excellent results with the great majority of infants. W. H. Park and L. E. Holt (*Medical News*, December 5, 1903).

Conditions which affect the Composition of Breast-milk.

AGE AND CONSTITUTION OF THE NURSE.—The milk of a woman between twenty and thirty-five years is richer in fat than at other ages. Moreover, a robust constitution contributes to an abundant milk-supply; still, many delicate-looking women make good nurses.

DEVELOPMENT OF THE BREASTS.—Breasts rich in glandular elements secrete the best milk. The conical breast which is not very large, and has but little fat, is usually the best form.

Statistics collected at Freiburg Maternity. Out of 525 in childbed, only one-half could suckle thoroughly during the first two weeks; 99 secreted no milk; 49 had imperfect nipples; 46 had fissured nipples; and 44 had insufficient secretion of milk. Only 33 suckled without unfavorable complications. Development of the nipple bore a direct relation to the value of the breast as a secretory

organ. Wiedow (Centralb. f. Gynäk.; Brit. Med. Jour., Aug. 17, '95).

NUMBER OF CHILDBIRTHS.—This has an influence only in so far as it affects the general health of the woman. The milk is apt, however, to give out earlier with each successive lactation.

ACUTE ILLNESS.—If mild and of short duration, there is no lasting effect; if severe and prolonged, the milk is reduced in quantity, the fat becomes low, and the proteids often high. In septic and suppurative disease bacteria may be found in the milk.

DIET.—A generous diet increases the fat and the proteids. A nitrogenous diet, consisting largely of meat, milk, eggs, beans, peas, etc., increases the fat more than the proteids; but, if the nurse takes little exercise, there is apt to be an excess in the proteids also. Large quantities of liquid increase the amount of milk; but the percentage of solids is diminished. Malted drinks increase the quantity, and raise the proportion of fat. If the diet is low, the milk becomes scanty, the fat is diminished, and the proteids usually diminished; if increased, they are often changed in character. No matter what the diet, the percentage of sugar remains practically unchanged.

DRUGS.—Only a few drugs are with certainty eliminated by the breast, and these in varying proportions. Alcohol, opium, atropine, chloral, and the iodides may be given off in an amount sufficient to cause symptoms in the nursling; likewise rhubarb, senna, castor-oil, and the saline cathartics. Occasionally the salicylates, copaiba, colchicum, antipyrine, turpentine, iron, and arsenic are eliminated in appreciable quantities. Mercury is excreted only in very small amount, after prolonged administration.

EXERCISE.—The quantity of the milk

is usually increased, and the proteids diminished by moderate exercise.

NERVOUS AND EMOTIONAL DISTURBANCES.—There are few influences that affect the milk so immediately and so strikingly as nervous impressions. Grief, anger, fright, passion, great excitement, and fatigue are apt to have a prompt and decidedly bad effect; so that the infant may be actually poisoned, and have an attack of severe acute indigestion, which may be accompanied by convulsions. The change in the milk is probably in the proteids, toxic nitrogenous bodies being formed.

MENSTRUATION.—Comparatively few infants are very much affected by the return of menstruation. The quantity of the milk is often diminished for the first day or two of the menstrual period.

PREGNANCY.—If pregnancy supervenes, the milk deteriorates steadily in quantity and quality.

Nursing.

“Will the mother be able to nurse the baby?” is a question the physician must frequently answer nowadays when an infant is born. No matter what the explanation, it is a fact that each year there are fewer women that can nurse their babies. In some conditions nursing is either impossible or inadvisable; in others the question can be answered only after a trial.

CONDITIONS IN WHICH NURSING SHOULD NOT BE ATTEMPTED.—1. If there is no milk secreted.

2. If tuberculosis is present in any form.

3. If there is malignant disease of the breast, or if there have been serious complications of parturition, as hæmorrhage, eclampsia, nephritis, or septicæmia.

4. The presence of chorea, epilepsy, or insanity precludes nursing.

In the above-mentioned conditions

nursing is deleterious to both the mother and the child.

CONDITIONS IN WHICH NURSING IS NOT LIKELY TO BE SUCCESSFUL.—1. If, on previous occasions, under favorable conditions the mother has been unable to nurse.

2. When the woman is of a very delicate constitution and highly nervous.

If nursing is attempted in these circumstances, the baby's weight and general condition should be carefully watched. The usual custom is to continue nursing as long as the infant thrives, but the mother's condition should be watched with equal solicitude, lest she be injured by continuing the nursing too long.

Care of the Nursing Woman.

DIET AND MODE OF LIFE.—The nursing woman should have a generous mixed diet, not excessive in nitrogenous food nor in vegetables. She should drink from a quart to a quart and a half of milk or milk-gruels daily. Meat, eggs; such cereals as oatmeal, rice, hominy, etc., bread, potatoes, all the common vegetables, and fresh fruits are allowed. Very highly seasoned foods, salads, cabbage, tomatoes, stale or unripe fruits, alcoholic drinks, strong tea, and coffee are forbidden. Whatever disturbs digestion is apt to produce a bad effect upon the milk, and should therefore be avoided.

The mode of life should be simple, with regular exercise,—by driving, early; or by walking, later, as soon as returning strength will permit. There should be no anxieties nor great excitement.

BREASTS AND NIPPLES. — At least a fortnight before confinement the nipples should be examined, and, if flat or depressed, they should be drawn out and the woman instructed to do this herself several times a day. If the nipples are

hard, borated vaselin or lanolin should be rubbed on them four or five times daily; if soft and macerated, they should be painted three times a day with equal parts of 50-per-cent. alcohol and glycerin.

During the whole of lactation the nipple should be cleansed with 2-per-cent.-boric-acid solution before and after nursing, and the breasts supported in a well-fitting corset. Slight excoriations are well treated by dusting them freely after each nursing with bismuth sub-nitrate; for fissures probably the best treatment is to paint with an 8-per-cent.-nitrate-of-silver solution once or twice a day, and either to use a nipple-shield or stop nursing for a time from the affected breast. It may be necessary to use nipple-shields because of the small size of the nipples, as well as because of fissures.

Nursing Rules for Healthy Infants.

Regular hours are very important, and should be adhered to from the beginning. This practice will do much to establish regular habits of sleep and regular movements of the bowels. If the child is asleep at the nursing-time it should be awakened. From the outset, moreover, the infant should take boiled water from a bottle at least once a day, not only for the water, but also to learn to use the rubber nipple.

It is generally not necessary to put the child to the breast until three or four hours after the birth; and even then it should be allowed to nurse only about five minutes. Aside from the fact that the breasts contain little milk until the third day, the nipples should be gradually accustomed to their function. After the second day the child may nurse from ten to twenty minutes.

The number of nursings a healthy infant should have in twenty-four hours,

together with the intervals and the number of night-nursings, is given in the subjoined table.

During the first few days of life, if the infant seems unsatisfied, the nursings may be supplemented by giving from 1 to 1 1/2 ounces of warm, sterile, 5-per-cent.-milk-sugar solution; this is made by dissolving an even tablespoonful of milk-sugar in 7 1/2 ounces of boiling water, and may be given from the bottle. It will frequently prevent the marked loss of weight and "inanition-fever" which often occur when the breast-milk is scanty.

Not only should the child gain in weight, but the flesh should be firm, and the cheeks, ears, and lips of good color.

LENGTH OF TIME AND MANNER OF NURSING.—The infant should always be ready to nurse at the proper time, but not overgreedy; and it should be satisfied after nursing ten, or at most twenty, minutes. Satisfaction is shown by relinquishing the breast voluntarily, and then either falling asleep or remaining contented and happy while awake.

VOMITING.—There should be no true vomiting; but there may be regurgita-

SCHEDULE FOR BREAST-FEEDING.

AGE.	NUMBER OF NURSINGS, IN 24 HOURS.	INTERVALS DURING DAY.	NIGHT-NURSINGS, BE- TWEEN 9 P.M. AND 7 A.M.
First day	4	6 hours	1
Second day	6	4 hours	1
Third to twenty-eighth day	10	2 hours	2
Fourth to thirteenth week	8	2½ hours	1
Third to fifth month	7	3 hours	1
Fifth to twelfth month	6	3 hours	0

Signs of Successful Nursing.
The following are the important features to be considered:—
WEIGHT.—All infants should be weighed once a week, and feeble infants twice a week during the first six months. A loss in weight during the first three or four days is normal, and amounts to about one-tenth of the infant's birth-weight. After about a week the regular gain for the first five months should be about six ounces per week; from the sixth month to the end of the first year there should be an average gain of from three-quarters of a pound to a pound per month. At five months the average healthy infant should have doubled its birth-weight, and at one year should have trebled it. It is to be noted that the gain during the second six months is more apt to be irregular, due to dentition, end of lactation, etc.

tion of small quantities of milk almost immediately after nursing,—due usually to overdistension of the stomach.
STOOLS.—There should be from one to three easy, natural movements daily; soft, smooth, and free from curds. After the disappearance of the meconium, about the fifth day, their color should be orange-yellow or yellow. Normally the reaction is acid.
SLEEP AND DISPOSITION.—During the first few weeks infants should sleep nearly all the time they are not nursing; at six months considerably more than half the time; and from then on until a year old they should take both a morning and an afternoon nap.
It is normal for a baby to cry from fifteen to thirty minutes daily; but fretfulness, peevishness, and sleeplessness, with the crying which accompanies them, are abnormal.

DEVELOPMENT.—With successful nursing there should be the signs of normal healthy development. In the muscles this is shown by the child holding up its head at the fourth month or earlier, sitting with the back unsupported at the eighth month or earlier, standing by the ninth month, and beginning to take steps by the end of the first year.

DENTITION should be regular, the lower central incisors appearing before the ninth month, and the upper incisors before the end of the year.

Signs of Unsuccessful Nursing.

TEMPERATURE.—During the first four or five days the most important sign of insufficient food is a rise of temperature: “inanition-fever,” so called. The range may be from 101° to 102° , or in extreme cases from 104° to 106° . If no obvious symptoms of illness are present, such a temperature before the fifth day may be regarded as due to inadequate nursing.

In the artificial feeding of infants a failure of the child to gain properly in weight is an indication of insufficient sugar, provided the other elements are in proper proportion. An excess of sugar produces colic or thin, green, watery stools. A harder and dryer condition of the stools than normal indicates too low fat percentage. Vomiting or regurgitation of food an hour or two after nursing indicates an excess of fat. The passage of curds in the stools points to an excess of proteid. E. B. Emerson (Boston Med. and Surg. Jour., Dec. 4, 1902).

WEIGHT.—Failure to make the proper gain, if not accounted for by existent disease, is nearly always due to inadequate nourishment.

LENGTH OF TIME AND MANNER OF NURSING.—If the infant habitually remains at the breast for more than twenty minutes; or if, after taking the breast with avidity, it soon turns away fretting,

only to resume in a minute or so, and finally gives it up disgusted and crying, the milk is probably too scanty. Sometimes the same thing is indicated by the baby refusing to take the breast. On no account should such an infant be pacified by letting it sleep on the breast or by giving it a rubber nipple.

VOMITING.—A few infants thrive, in spite of considerable regurgitation. But, if the vomiting is between feedings and habitual, the sign is important.

COLIC.—If only occasional, colic does not mean much, even though severe; but the baby that has continual discomfort, with more or less flatulence, is not getting the proper kind of milk.

STOOLS.—That the nursing is improper may be shown either by constipation, with dry, light-colored or greenish stools of foul odor, or by diarrhoea, with thin yellow or green stools, four to ten a day, which contain curds and, after a time, mucus.

SLEEP AND DISPOSITION.—Sleeplessness, restlessness, and fretfulness are generally due to either hunger or indigestion.

DURING THE LATTER PART OF LACTATION the signs of inadequate nursing, in addition to those already given, are: stationary weight or actual loss, delayed dentition, delayed closure of the fontanelle, flabby muscles with inability to sit or stand at the proper age, and anæmia. There may be also symptoms of malnutrition or of incipient rickets.

The presence of all or of any one of these symptoms is enough to arouse suspicion, and the physician must determine whether the quantity or the quality of the breast-milk is at fault or both. This can be made out by the method already described, and then the proper treatment instituted as indicated below.

Means of Improving Breast-milk when Nurslings are not Thriving.

WHEN THE MILK IS POOR an important consideration is whether this quality is due to a temporary or accidental cause—as severe labor or one of the complications of labor—or to a constitutional cause. In the former case much may be done; in the latter, almost nothing. If the milk is poor and scanty, the woman's general condition should be improved by giving a diet consisting largely of meat, milk, gruels, and liquids in abundance; a good extract of malt may be added. Out-of-door exercise, plenty of sleep, and freedom from anxiety are especially important. Gentle local massage often gives gratifying results; but it is imperative that the breasts and the hands of the operator be scrupulously cleansed before the manipulations are begun. (See AGALACTIA, volume i.)

WHEN THE MILK IS EXCESSIVELY RICH, AND THE QUANTITY ABUNDANT, a reduction in the amount of meat, and the abstention from malted or alcoholic drinks, with active out-door exercise, will usually reduce the ingredients to the standard. This condition of the milk frequently obtains with wet-nurses.

To conclude, if the milk is very rich, the proportions can usually be reduced, by careful observation of the measures recommended, to a point where the infant is able to digest it. If the milk is poor and scanty there is less probability of success. In either case, *if, after two or three weeks' trial, the milk has not improved*, and the child continues to suffer from indigestion, *it is better to wean at once, or secure another nurse*, rather than persist longer in the attempt.

Wet-nursing.

In the majority of cases artificial feeding is to be preferred to wet-nursing, but in some cases the latter is a necessity.

To secure a good wet-nurse is difficult, and there is no certainty that her milk will agree with the foster-child. The ideal wet-nurse is a healthy, young, unmarried primipara that lost her infant shortly after birth; she should be phlegmatic in temperament, and of sufficient intelligence to nurse the baby regularly. The actual wet-nurse in this country is usually a buxom married multipara whose baby and home-cares keep her constantly dissatisfied with her temporary occupation. One may approximate the ideal by selecting a healthy woman between twenty and thirty, not necessarily a primipara, who has a thriving infant. Women with syphilis, tuberculosis, chorea, or epilepsy should be excluded, both by their history and by examination of the hair, throat, skin, lymph-nodes, and chest. The breasts should be well-developed glands that become hard with milk within three hours after a nursing; the nipples should be of good size, well formed, and free from fissures.

In each of ten children fed by wet-nurses examined, the writer found streptococci present in the mouth. In cultures made from the tonsils he found streptococci only five times. In four instances he killed mice with the streptococci obtained by culture, but he was never able to recover these organisms from the animals. The streptococci varied greatly in the length of the chains; and, particularly after one or two cultures, their character became entirely altered. Herzberg (*Deutsche med. Wochen.*, Jan. 1, 1903).

The wet-nurse's child should, of course, be carefully examined. In regard to the age of the child, it need not correspond very closely to that of the foster-child. In general, the milk should not be more than six weeks old for a child of one to three weeks: if the foster-

child is over six weeks, the milk may be from one to four months old.

An important caution is to see that the nurse is not overfed, and that she takes regular active out-of-door exercise; otherwise the milk is apt to become too rich.

Breast-milk is the best infant-food. No artificial food should be trusted unless it contains the essential elements of breast-milk—namely, fat, proteid, and sugar. These elements are to be found only in milk, and cows' milk is the only milk available for general use. Cows' milk must be modified in order to bring the percentages of the three elements to correspond with those found in human milk. E. T. Abrams (*Medical News*, Nov. 29, 1902).

Weaning and Mixed Feeding.

With few women among the better classes can nursing be continued beyond the ninth, and generally not beyond the sixth or seventh month, without exhausting the mother or partially starving the child.

WHEN SHOULD WEANING BE BEGUN?—Stationary weight or actual loss, the child being otherwise well, means insufficient food. After the sixth or seventh month this indicates weaning. Before the sixth month the attempt may be made to improve the milk by the means already suggested, using in the meantime supplemental bottle-feedings two or three times a day. If the milk does not become normal in amount, it may still satisfy the infant at three or four nursings daily, the bottle being given in place of the other nursings. This method of "mixed feeding" may be profitably continued as long as the child thrives: it is much better for the child than complete weaning. If the nurse cannot satisfy the baby at least twice a day, the child had best be weaned. Speaking generally, weaning should be begun at the ninth or tenth

month; but even then the weekly weighing is the safest guide.

It is a great mistake quickly to abandon breast-feeding for 'artificial feeding on the ground that the mother's milk is not of proper composition and does not agree. Far too many instances observed of the damage which has come from the too hasty recommendation to wean which has been given by the family physician. Caution against the use of patent commercial foods, which contain, as a rule, a large amount of unaltered starch. J. P. Crozer Griffith (*Amer. Medicine*, May 3, 1902).

METHOD OF WEANING.—At whatever time begun, the process should be gradual, if possible, lest the mother have trouble with her breasts, and the child with its stomach and bowels. At first a bottle should be given twice a day: if the food causes no indigestion the number of feedings and the quantity may be gradually increased up to the full quota for the child's age, according to the table below, under "Modification of Milk for Healthy Infants During the First Year," page 227.

As to the formulæ to be used, if the baby is under four months old, the food for the first few days should be as weak as that for a newborn child; if from four to nine months, the formula should be at first that for a month-old child; and, if from nine to twelve months, that for a three-month child. The important point is always to start with a sufficient quantity of very dilute food, and afterward increase the proportions as rapidly as the child can assimilate them.

Artificial, or Substitute, Feeding.

In order that an infant may properly thrive on an artificial food, certain fundamental principles must be complied with, viz.:—

1. The food must contain the same ingredients as breast-milk, and in about the same proportions.

2. As nearly as possible the fats, sugar, and proteids of the food should

good breast-milk and cows' milk is given in the table:—

CONSTITUENTS.	WOMAN'S MILK, AVERAGE.	COWS' MILK, AVERAGE.
Fat	4.00 per cent.	3.50 per cent.
Sugar	7.00 per cent.	4.30 per cent.
Proteids	1.25 per cent.	3.75 per cent.
Salts	0.20 per cent.	0.70 per cent.
Water	87.55 per cent.	87.75 per cent.

resemble those of breast-milk, both in chemical composition and in their behavior to the digestive fluids.

3. The addition to the food of very young infants of substances not present in breast-milk (*e.g.*, starch) is rarely advisable, and if used in large quantity may be positively harmful.

In accordance with these principles, cows' milk is selected, because it furnishes the elements required, although not in the proportions best suited to the infant's needs.

An infant fed at the breast, who suffers persistent indigestion and at the same time fails to gain in weight, should be taken from that breast. If, however, the infant gains in weight it is better to try and correct the indigestion by treatment directed both to the mother and child. To attempt artificial feeding in such a case often only adds to our troubles.

In commencing artificial feeding a weak mixture should be begun with, and worked up by frequent, but slight, changes to a point of tolerance. By still continuing a gradual, but steady, increase, never beyond the point of easy digestibility, we can in a few weeks attain to a food sufficiently nutritious in all its ingredients and yet fully digestible and assimilable. It is a serious mistake to begin on a mixture too strong, and work down after weeks of indigestion to the point of tolerance. Blackader (*Montreal Med. Jour.*, July, 1902).

Cows' Milk.

DIFFERENCES BETWEEN COWS' MILK AND BREAST-MILK.—The composition of

It appears, therefore, that cows' milk contains a large excess of proteids and of salts, but too little sugar; the fat is present in about the same proportion in both. Moreover, cows' milk is acid in reaction and contains numerous bacteria.

FAT.—The average amount of the fat of cows' milk which a healthy infant can digest varies from 2.0 to 4.5 per cent. Beginning with 1.5 per cent., or lower, in the early days of life, the amount may be increased to 3.0 per cent. at one month, and 4.0 per cent. at five or six months.

SUGAR.—The sugar in both kinds of milk is simply lactose in solution; but the proportion in cows' milk is only about two-thirds that in breast-milk.

PROTEIDS.—The proteids show the greatest differences, both in quantity and in character. A good average breast-milk contains nearly 1.5 per cent. of proteids, of which about one-third is casein, and the other two-thirds the soluble and easily digestible lactalbumin. Cows' milk contains nearly 4.0 per cent. of proteids, of which four-fifths is the insoluble and difficultly-digestible casein, while only about one-fifth is lactalbumin. Stated in another way, breast-milk contains about 1.0 per cent. lactalbumin, and 0.5 per cent. of casein, while cows' milk contains only about 0.8 per cent. of lactalbumin, but 3.2 per cent. of casein. On account of the relative indi-

gestibility of the proteids of cows' milk, lower percentages have to be used than those in breast-milk, especially for the first two or three months. During the first few days infants can rarely digest a higher proportion of the proteids of cows' milk than 0.5 per cent.; by the end of the first month the average child can take 1.0 per cent., by the fourth month nearly 1.5 per cent., and by the sixth month 2.0 per cent.

It is doubtful if cows' milk can be modified so as to make it exactly resemble mothers' milk, for the proteids of the former differ unquestionably from those of the latter, both in quality and in quantity. The undoubted advantage, however, is that in the milk-laboratory the percentage-composition of the cows' milk can be altered to suit the idiosyncrasies of the infant's digestion, while we have far less control over the percentage-composition of the breast-milk of the mother or wet-nurse. Henry Ashby (Med. Chronicle, Aug., '97).

INORGANIC SALTS.—The salts are about three and a half times more abundant in cows' milk.

Proportion of iron very similar in human and in cows' milk; slight excess of the oxide in latter. Anselm (Centralb. f. klin. Med., Sept. 7, '95).

REACTION.—The reaction of cows' milk is acid, while that of human milk is generally alkaline, rarely neutral.

BACTERIA.—Breast-milk is practically sterile, while cows' milk always contains germs, some of which may be pathogenic. A large proportion of diarrhoeal diseases are believed to depend upon the saprophytic bacteria; and typhoid, cholera, diphtheria, tuberculosis, and scarlatina may be transmitted by cows' milk.

MODIFICATION OF COWS' MILK.—Because of the differences noted above between breast-milk and cows' milk, certain modifications must be made to adapt cows' milk to the digestion of the average infant.

Proteids.—Most important is a reduction in the proportion of the proteids. This can be effected by simply diluting the milk.

Sugar.—Sufficient sugar must be added to bring the proportion in the food up to between 5 and 7 per cent. Good milk-sugar is preferable in the great majority of cases, but where it is not obtainable, or where it causes indigestion, granulated sugar may be used, and with many infants answers quite as well. The quantity of cane-sugar used, however, should be only about half the amount of milk-sugar required, because, if added in full quantity, it makes the food too sweet.

A thorough examination of the sources of all milk for general use is imperative, and the laboratories supplying this milk should be under the most careful supervision. Cows' milk should be reduced to the proportions of woman's milk, and a slightly acid milk should be transformed to one of slightly alkaline reaction in preserving it from a contamination and making it as nearly as possible like a mother's milk. Cows' milk is approximately 4 per cent. of fat, 4 per cent. of sugar, and 4 per cent. of proteids. In consequence, then, it is necessary to remember three formulas: Feeding for the newborn, adapted to the majority, should comprise 2 per cent. of fat, 5 per cent. of sugar, 0.75 per cent. of proteids. Low-average breast-milk should contain 3 per cent. of fat, 6 per cent. of sugar, and 1 per cent. of proteids. High-average breast-milk, 4 per cent. of fat, 7 per cent. of sugar, and 2 per cent. of proteids. These modifications should be regulated gradually and frequently by small fractions from one to another. From eight to ten months it is time to make the proportions approximate that of the whole cows' milk. W. P. Northrup (N. Y. Med. Jour., Mar. 16, 1901).

Fat.—Diluting the milk to reduce the proteids diminishes the proportion of fat also; so that cream must be added,

or specially rich milk used, in order to have the fat in proper amount.

Inorganic Salts.—The excess of salts in cows' milk is about the same as that of the proteids; so that the dilution required for the proteids will reduce the salts to about the proper proportion.

Reaction.—The acidity of cows' milk may be overcome by adding 1 ounce of lime-water for each 20 ounces of the food, or by adding about 1 grain of bicarbonate of soda for each ounce of the food. The soda is preferable where there is constipation.

water. The gruel is stirred and kept warm until it becomes thin and watery. The top-milk taken from the original bottle with the digested gruel is then diluted and sugar is added. The food for a young infant should contain from one-eighth to one-third of the 9 ounces of top-milk. The food for an older infant should contain one-sixth to two-thirds of the 16 ounces of top-milk. Sugar is added to make up for the amount lost in the dilution. When the milk cannot be kept below 60° F., it will have to be pasteurized. When there is vomiting of food, the digested gruel may be fed temporarily, and a top-milk poorer in fat used for making up the

	MOTHERS' MILK.	MALTED MILK.	NESTLE'S MILK-FOOD.	IMPERIAL GRANUM.	MELLIN'S FOOD.	PEPTOGENIC MILK-POWDER.
Specific gravity	1031.00	1025.00	1024.00	1025.00	1031.00	1032.00
Water	86.73	92.47	92.76	91.53	88.00	86.03
Total solid matter (by direct determination)	13.26	7.43	7.24	8.47	12.00	13.97
Inorganic salts	0.20	0.29	0.13	0.34	0.47	0.26
Total albuminoids	2.00	1.15	0.81	2.15	2.62	2.09
Soluble albuminoids	2.00	1.15	0.36	1.67	2.62	2.09
Insoluble albuminoids		trace	0.45	0.48		
Fat	4.13	0.68	0.36	1.54	2.89	4.38
Milk-sugar	6.93	1.18	0.84	2.71	3.25	7.26
Cane-sugar			2.57			
Maltose		3.28	trace	trace	2.20	
Dextrin		0.92			0.53	
Soluble starch			0.44	0.58		
Starch			1.99	1.22		
Reaction	alkaline	alkaline	alkaline	alkaline	alkaline	alkaline

A simple, accurate method of substitute infant-feeding. In preparing the infant-food it is necessary to have the milk bottled at the dairy and kept at low temperature. From 9 to 16 ounces are dipped from the top of the bottle (avoiding the siphon), and then the milk-bottle is set aside. Dextrinized gruel is then prepared in the following manner: Beat into a smooth, thin paste with a little cold water two heaping tablespoonfuls of wheat or barley flour and a quart of boiling water, and boil the gruel for about fifteen minutes. It is then cooled and a preparation of diastase is added. The aqueous solution of diastase should be prepared at home by soaking malted barley-grains in cold

next feeding. H. D. Chapin (New York Med. Jour., Feb. 23, 1901).
Centrifugal cream is probably less desirable for infant-feeding than gravity cream. As obtained from dealers it is often far from accurate in percentage. Siphonage for obtaining gravity cream is an accurate method, but one requiring considerable skill to perform accurately and safely. Dipping off the top-milk is an accurate and safe method if reasonable care is used. The method for obtaining gravity cream by pouring off the top is very accurate and extremely simple. There is no instrument to be bought and kept clean. By this method it is possible to obtain cream of any desired percentage up to 26 per cent. To

insure perfect accuracy, frequent examinations with the Babcock machine are required; but for practical purposes this is not necessary, provided the mixed milk from a well-regulated dairy is obtained. C. W. Townsend (Boston Med. and Surg. Jour., April 16, 1903).

Sterilization and Pasteurization of Milk.

The purposes of "sterilizing" milk are: 1. The destruction of pathogenic bacteria which may have gained entrance. These are the germs of typhoid, diphtheria, cholera, tuberculosis, and those which produce diarrhoeal diseases. The milk may receive this contamination from disease in the cow, from the milk-er's hands, or from the water in which the pails, cans, and jars are washed. The close connection which exists between the diarrhoeal diseases of summer and a contaminated milk-supply must never be lost sight of. The fact that these pathogenic germs are so frequently present, together with the fact that milk in cities is twenty-four to forty-eight hours old, and must often be kept without ice, makes some means of destroying the germs desirable or imperative.

2. The destruction of the ordinary germs of lactic-acid fermentation is desirable in order that the milk may be kept safely for a longer time.

"STERILIZING" THE MILK AT A HIGH TEMPERATURE is the method first proposed for destroying the germs. This so-called "sterilization" means heating it to a temperature of 212° for sixty to ninety minutes. This kills all the germs not in spore form, and such milk will keep for a week at ordinary room-temperatures.

In milk which is supposed to be sterilized there can always be found certain species of aërobic bacteria, which possess peptonizing properties. Five varieties of bacillus lactis peptonans isolated resembling the bacilli of Flügge and

Bujwid. Expensive methods have no advantage over boiling in an ordinary clean vessel. After being boiled, milk should be kept at a temperature under 60.8° F. Sterlong (Provincial Med. Jour., July 1, '95).

Complete sterilization of milk is not accomplished in less than 1½ to 2 hours at a temperature of 212° F. reckoned from the moment when this temperature is attained. Troitzky (Arch. f. Kinderh., B. 19, S. 97).

STERILIZING AT A LOW TEMPERATURE, OR PASTEURIZATION, is the second and preferable method. By pasteurizing is meant heating the milk for half an hour or more at a temperature of from 155° to 170°. This is sufficient to destroy the pathogenic germs, though not their spores; such milk will keep on ice for only two or three days.

Pasteurizing for thirty minutes at 158° F. destroys bacilli of tuberculosis, diphtheria, typhoid, and cholera, but does not kill the bacteria which cause milk to spoil. Temperature of 200° F. destroys all lactic-acid bacteria. Partially sterilized milk must be kept below 65° F. or consumed within twelve hours. Flügge (N. Y. Med. Jour., Dec. 1, '94).

Milk to be subjected to a temperature of 155° F. for half an hour and should be used within twenty-four hours. Bureau of Animal Industry, Washington (Coll. and Clin. Rec., Mar., '95).

[Freeman's pasteurizer is the simplest apparatus for sterilizing at low temperatures. It may be obtained from most large drug-stores, or from James Dougherty, No. 411 West Fifty-ninth Street, New York City. L. EMMETT HOLT and L. E. LA FETRA.]

High-temperature sterilization would seem to be the ideal method; but it is open to certain objections. In the first place it changes the taste to that of boiled milk, which many children do not like. It renders the milk constipating and the casein more difficult of digestion. Furthermore, the nutritive properties of the milk are somewhat im-

paired; for it appears now beyond dispute that the use of sterilized milk as the sole diet for a long time is not infrequently followed by the production of scurvy.

The chemical result of boiling milk is to kill all the living cells, and to coagulate all the albuminoid constituents.

There is a very distinctly appreciable lowered vitality in infants which are fed on boiled milk. The process of absorption is more delayed, and the quantity of milk required is distinctly larger for the same amount of growth and nourishment of the child than is the case when fresh milk is used. J. L. Kerr (Brit. Med. Jour., Dec. 14, '95).

Comparatively or temporarily sterilized milk may be administered for any length of time without fear, but sterilized milk that is put into hermetically-sealed vessels, and which can thus keep fresh for several or many days, will produce scurvy unless some fresh food is administered daily. One meal of fresh whey daily will achieve this in younger infants than those who may have fresh vegetables, meat, or fruit. J. K. Barton (Brit. Med. Jour., Jan. 2, '97).

Study of the subject showed that the disadvantages of sterilizing milk in the artificial feeding of infants lie chiefly in those changes effected in milk by high temperatures. These alterations are not only chemical, but also physical, and are so profound and important that they interfere seriously with the absorption and assimilation of the milk. A prolonged feeding with sterilized milk not only destroys the balance of nitrogenous metabolism, but also interferes with the growth of the body, all the more because the salts are changed in character by sterilization, and so an insufficient amount of the salts necessary for nutrition is absorbed. Sterilized milk, therefore, induces a defective development of the body and renders it more susceptible to the invasion of diseases, especially to maladies of the blood, the general metabolism, and constitutional diseases. These facts, the author believes, should be sufficient to

relegate sterilization to the past. N. P. Daniloff (Russky Vrach, Feb. 15; New York Med. Jour., April 25, 1903).

Cows' milk is the best substitute for mothers' milk, when properly prepared; but cows' milk is not bettered by sterilization or pasteurization; on the contrary, this treatment undoubtedly makes it the direct cause of rickets and scurvy and kindred diseases in children. The object of pasteurization can be safely accomplished by receiving the milk in sterilized quart bottles, which are then tightly sealed, labeled with the dairyman's name and the date, and cooled immediately in a temperature of 40° F. E. M. Sill (Medical Record, Dec. 27, 1902).

Pasteurization does not change the taste nor make the milk constipating, nor does it render the casein less digestible. Whether pasteurizing the milk changes it so that scurvy may result is not determined; certainly the danger is so slight that it may be disregarded.

Pasteurization is recommended in all cases during the warm months. Sterilization is advised only for use among the very poor, in cities during very hot weather, in any place where ice is not obtainable, and for transportation on long journeys. In cool weather, with a fresh, clean milk-supply and plenty of ice, neither method is necessary.

Investigation of the milk-supply of New York City shows that both in winter and summer the ordinary commercial milk upon its arrival in the city is within the incubation-period, this stage lasting 24 hours in winter, 13 to 17 hours on a fairly cool day, and 5 hours on a hot summer day, after reaching the city. This milk is therefore considered fit for infant-feeding, if prepared early in the day. On a warm summer day pasteurized milk had a fairly stationary acidity for from 10 to 12 hours, the acidity then rising slowly until at the end of 24 hours the milk was curdled. The growth of the bacterium lactis was thus retarded about 6 hours as compared with unpas-

teurized milk. On the other hand, sterilization at from 90° to 92° C. for 40 minutes, while making the milk far from absolutely sterile, rendered the bacterium lactis inert for 2 days at least, at a summer temperature. It may therefore be concluded that without subsequent refrigeration pasteurization in summer does not offer a safe means of preparing milk for infant-feeding. Emily Lewi (N. Y. Med. Jour., Feb. 9, '95).

Since using pasteurized milk, the death-rate from diarrhœal diseases in Brooklyn has been lower in 1896 and 1897 than it had ever been. George P. West (San. Record, Nov. 26, '97).

While neither sterilization nor pasteurization renders the milk more digestible, so many dangers of gastro-intestinal infection are removed by their use that they are to be regarded as valuable safeguards.

Number of cases of mild milk-infection noted occurring among children fed upon pasteurized milk or milk-mixtures. The

perature of at least 194° to 198° or 212° F. for ten minutes. It should be rapidly cooled and kept below 20° C. till ready for use. Koplik (Med. Rec., Feb. 19, '98).

Modification of Milk for Healthy Infants during the First Year.

Not all infants, even those who are healthy, can be fed in the same way. The problem, therefore, is to make a food in which the quantity of each ingredient—fat, sugar, and proteid—shall be known, and in which, also, these quantities can be separately varied so as to suit the individual child. At present the percentage method has come to be generally used by those who have had the greatest experience in the feeding of infants.

The following table may be taken as a general guide for feeding a healthy infant of average weight by the percentage method. The schedule shows the per-

AGE.	FAT.	SUGAR.	PROTEIDS.	DAILY QUANTITY.
First day		5.00 per cent.		4 to 8 ounces
Second, third, and fourth days . .	1.00 per cent.	4.00 per cent.	0.33 per cent.	8 to 12 ounces
Fifth, sixth, and seventh days . .	1.50 per cent.	5.00 per cent.	0.50 per cent.	10 to 15 ounces
Second and third weeks	2.00 per cent.	6.00 per cent.	0.60 per cent.	18 to 30 ounces
Fourth week	2.50 per cent.	6.00 per cent.	0.80 per cent.	20 to 32 ounces
Second and third months	3.00 per cent.	6.00 per cent.	1.00 per cent.	22 to 36 ounces
Fourth month	3.50 per cent.	7.00 per cent.	1.25 per cent.	28 to 38 ounces
Fifth month	3.75 per cent.	7.00 per cent.	1.50 per cent.	32 to 38 ounces
Sixth to ninth month	4.00 per cent.	7.00 per cent.	2.00 per cent.	34 to 42 ounces
Tenth to twelfth month	4.00 per cent.	6.00 per cent.	2.50 per cent.	38 to 45 ounces

symptoms are sometimes insidious; sometimes marked and troublesome. In some cases there will be first a looseness of the bowels; the movements suddenly increasing to 5 or 7 per day, and are curdy and acid. There may be some fever. In other cases the green acid stools will disappear after a dose of castor-oil. Again, several normal stools may be followed by a semifluid, extremely-acid stool and the child be very weak, or there may be simply no gain in weight and rather fluid stools. All these cases improve rapidly under a change from pasteurized to sterilized milk. Milk should be heated to a tem-

centage of fat, sugar, and proteids, and the daily quantity.

During the first month of life an average infant requires about ten feedings of from 1 to 2 ounces daily. During the second and third months from 2 to 4 ounces, and so on. As the amount is increased the number of feedings must be reduced and the interval between each lengthened.

An average formula for a healthy infant during the first week of life would be: fat, 2.0; sugar, 6.0; proteid, 0.6. The percentage may then be gradually increased to reach: fat, 3.0; sugar, 6.0;

proteid, 1.0, by the end of the first month. By the third month a healthy infant thrives well on a mixture such as: fat, 4.0; sugar, 7.0; proteid, 1.5.

As a rule, those of largest experience find they get the best results from rather low-percentage mixtures. D. J. Evans (Montreal Med. Jour., Oct., '97).

Five deaths among forty-two children suckled on the various samples of milk submitted to analysis. In each of the fatal cases, with one exception, the percentage of proteids was high, ranging from 2.05 to 4.02. In every case but three of the whole number in which the proteids exceeded 2.5 per cent. the milk disagreed. Variations in the percentage of the other ingredients seem to be much more readily borne. The composition of milk which agrees with the infants is as follows:—

WATER.	FAT.	SUGAR.	PROTEIDS.	ASH.	REFRACTIVE INDEX OF FAT.
88.12	3.11	6.70	1.83	0.24	51.9°

Sheridan Delepine (Brit. Med. Jour., Jan. 22, '98).

The percentages recommended by Rotch in the case of children premature at the twenty-eighth week are as follows:—

Proteid, 0.5 per cent.; fat, 1.0 per cent.; sugar, 3.0 per cent.; 24 meals each of 1 drachm; heat to 167° F. and make slightly alkaline.

These amounts can be gradually increased until at the thirty-sixth week the child will be taking such a mixture as this: proteid, 1.0 per cent.; fat, 2.0 per cent.; sugar, 5.5 per cent.; and, if it thrives, further additions can be made until the composition resembles that of good human milk.

If modified milk be not obtainable, the child must be fed upon humanized milk, if necessary diluted, or condensed milk sufficiently diluted, or a mixture of boiled cows' milk, water, and cream, in the proportion of about 1 part of milk to 4 of water, with $\frac{1}{2}$ teaspoonful of cream to the ounce, if it can be obtained fresh and good.

Very premature children must at first be fed every hour, and not more than 1 to 2 drachms must be given at a time. The amount of food given and the intervals between the meals must be very gradually and carefully increased. If the child be very feeble, brandy may be given, about 5 drops every two hours, repeated as often as may be necessary, and if it at any time become markedly cyanotic, oxygen gas should be administered. It may be given from five to ten minutes two or three or more times a day. G. F. Blacker (Practitioner, July, '98).

MILK - LABORATORIES. — There have been established in Boston, New York, Philadelphia, and several other cities laboratories where it is possible to obtain milk in which the separate ingredients are present in definite percentages. These Walker-Gordon laboratories perform the same service in the preparation of milk that the apothecary does in the dispensing of drugs. They put up what is technically known as "modified milk" according to prescription, and will further sterilize or pasteurize the food if desired. In ordering the milk, the physician simply specifies the percentages of fat, sugar, and proteids which he wishes his patient to have, together with the quantity for each feeding and the number of feedings in twenty-four hours; also the amount of lime-water, and whether the food is to be sterilized, pasteurized, or delivered raw. The laboratory company sends each day's supply every morning, delivering the food in the bottles from which it is to be fed. The advantages of the laboratory method are many, as the physician can vary the proportions from day to day, and feel sure that his directions are carried out. The only objections are the expense and the fact that these laboratories are as yet established in only the larger cities.

Laboratory milk is theoretically the most perfect substitute for normal

human milk, but personal experience, however, fails to support the theory. In some cases it proved satisfactory; in others partially satisfactory, and showed features of malnutrition; but in the greater number unsatisfactory, and it became absolutely necessary to discontinue the laboratory feeding, owing to the occurrence of acute dietetic disorders. In laboratory milk the proteids are present in a form that makes them difficult of digestion, due to the destruction of the natural emulsion in the process of mixing a separated milk and a centrifugated cream. Louis Starr (*Archives of Pediatrics*, Jan., 1900).

HOME-MODIFICATION OF MILK.—Various methods have been suggested for home-modification, all somewhat complex. At present it cannot be said that the ideal method has been devised. All are only approximate in their results, but they are highly satisfactory, if the details are carefully carried out.

[Dr. W. L. Baner, in the *New York Medical Journal* of March 12, '98, gives some simple equations by the use of which the amount of each ingredient for all the ordinary formulæ may be readily calculated.

Ten-per-cent. cream used to make up a 20-ounce mixture; hence each ounce of the cream adds 0.5 per cent. of fat, 0.2 per cent. of sugar, and 0.2 per cent. of proteid.

A simple device for making up the ordinary formulæ is the "Materna" Milk-Modifying Apparatus. It is a glass graduate with the sides divided into several panels, and with marks indicating the level to which the vessel should be filled with the various ingredients to obtain the formula noted at the top of the panel. Although the method is not very accurate, it has simplicity to recommend it. The apparatus is made by the Surgical & Chemical Supply Co., No. 147 Centre Street, New York City, and may be obtained from them or from most druggists. L. EMMETT HOLT and L. E. LA FETRA.]

Clinical observation has confirmed the truth of the statement regarding the

diminution of the percentages of the other ingredients as the fat is increased. Physicians quite commonly overlook the effect on the result of varying the quantity of cream taken from the upper part of the milk-bottle, and of the influence of temperature and the time the milk is allowed to stand. Thus, if 2 ounces are taken from the upper part of a quart of milk that has been standing for 16 hours, it will contain $7\frac{1}{2}$ times as much fat as proteids, whereas if 4 ounces are taken from the upper portion of a quart of milk that has been standing only 8 hours, it will be found to contain $3\frac{1}{3}$ times more fat than proteids. Many of the poor results obtained in feeding of infants on modified milk can be ascribed to the use of milk containing too low a percentage of proteids. The muscular development of the child is very largely dependent upon the percentage of proteids present in the food. J. E. Winters (*Phila. Med. Jour.*, Mar. 24, 1900).

Milk sterilized by heat is altered to an extent varying according to the elevation of the temperature used in the sterilization and the duration of its exposure, in the following respects:—

1. Its proteids are modified and rendered apparently less digestible; but our knowledge on this subject is still indefinite and dependent chiefly on clinical experience; nothing has yet been proved by laboratory experiment.

2. The combination of its saline ingredients with the proteids—a combination which we must admit is not absolutely proved, but which appears to be extremely probable—is more or less broken, and the salts assume a condition in which they are less readily absorbed.

3. Natural ferments whose presence in milk may with much probability be inferred, and which may materially assist its digestion in the infant's stomach, are destroyed.

4. An alteration takes place in the emulsion, normal to milk, which may also have a distinct effect in lessening the digestibility of cows' milk by the infant.

It is extremely important that milk after sterilization should be kept at a continuously low temperature, and it is

to be remembered that the employment of sterilized milk which has been kept for many days is not free from danger.

It appears, therefore, extremely desirable in infant-feeding to use fresh milk drawn with such careful precautions as to be practically free from extraneous bacteria, and in which the lactic-acid-producing bacteria are present in such small numbers as to induce no alterations of moment.

Such milk is better not sterilized at all. But it is seldom our good fortune to be able to obtain such with the regularity necessary for the daily preparation of an infant's food. And when our supply cannot be depended upon it appears the lesser of two evils to have the milk sterilized, but sterilized at the lowest efficient temperature, namely: 60° C., maintained for fifteen minutes. A. D. Blackader (N. Y. Med. Jour., Feb. 2, 1901).

To break up the curd of cows' milk and furnish a small quantity of easily absorbable food, cereal gruels, in which the starch has been converted into dextrin and maltose, are the most practical and desirable agents. Recently it has been admitted that cereals gave the finest curds of any diluent. How much effect a digested gruel has on the curdling of milk depends on the strength of the gruel and the dilution of the milk. The very best effect, as far as digestive effort is concerned, is obtained when the starch is completely gotten into soluble forms so that the particles of proteids and cellulose of the cereals are free.

To find what strength of the digested gruel was needed to prevent the formation of leathery curds, 3 heaping tablespoonfuls of wheat-flour, weighing 1562 grains, were cooked in a double boiler for two hours with 3 pints of water. This gruel was cooled so that it could be tasted (130° F.), and 1 teaspoonful of cereo, a glycerite of diastase, was added. At the end of ten minutes iodine failed to show starch.

It is not necessary to use a digested gruel stronger than 1 heaping tablespoonful of flour to the pint for any dilution of milk.

If, when modified milk disagreed, all milk was cut off for a few feedings, and then a new beginning made, a great deal less trouble would be experienced than by attempting to shift the percentages slightly.

There is no form of nourishment so easily borne as predigested cereal gruels, and when properly used these are of great benefit even when the infant is breast-fed.

If, instead of claiming that it is unscientific to give a baby anything but milk, the great advantage of temporarily withholding milk when it disagrees, and feeding cereal gruels instead of proprietary foods, was taught, and then to return to milk-feedings by gradually adding milk to these gruels, there would be less recourse to proprietary foods, and more practitioners would learn to become scientific modifiers of milk. This method can be followed anywhere, and in no way interferes with the principle of shifting the percentages of fat, sugar, or proteids to suit the infant's digestion. In fact, this is exactly what should be done in every case.

The conclusions are: that chemical analyses of milk are not the only scientific bases of comparison; that Nature adapts an animal's milk-food to its digestive system, and that cows' milk and woman's milk were intended for different digestive systems: that, as cows' milk forms solid curds and woman's milk flocculent curds, the curd of cows' milk intended for an infant should be broken up mechanically; that, as cereal gruels mechanically break up the curds of cows' milk, and as infants are able to utilize them, their use is rational.

It is often preferable to make the standard diluent of digested gruels, as they not only break up the curds, but expose a surface of milk-proteids, and not starch, and furnish a certain amount of nourishment that is immediately available for carrying on the work of digestion, taking the place of part of the soluble proteids, and also form a satisfactory substitute for milk when it must be withheld for a few feedings. A great variety of food can be supplied an infant by means of digested gruels at a trifling

expense, and the tendency is always to get back to milk-feedings, and not to keep on indefinitely with a diet of carbohydrates, as when most infant-foods are used. H. D. Chapin (Med. Record, July 6, 1901).

Use of whey as a diluent in place of water has of late come into prominence and has been given a sufficient trial to warrant the opinion that its use in cases of very difficult digestion, in which only low percentages of caseinogen are tolerated, is often of great value. It allows a physician to give a higher total proteid than would otherwise be possible. Maynard Ladd (Boston Med. and Surg. Jour., 1903).

HOME-MODIFICATION BY USING STANDARD CREAM AND MILK MIXTURES.—This method is that which we have found the simplest, and, therefore, the most satisfactory.

In order to produce definite results by diluting milk, it is necessary to know, approximately at least, the average composition of the milk or the cream-milk mixture which is to be diluted. For practical purposes, mixed herd-milk may be considered as containing 4 per cent. of fat, 4.3 per cent. of sugar, and 4 per cent. of proteid. In Alderney and Jersey milk the fat is much higher. Cream—if obtained by the gravity method, the milk standing twelve hours—contains about 16 per cent. of fat. Light or thin centrifugal cream has about 20 per cent. of fat, while the heavy centrifugal cream contains from 30 to 40 per cent. of fat. Top-milk is the upper portion of the milk with the cream, taken after the milk has stood a definite number of hours. If, for example, one quart of milk stands on ice for twelve hours, the cream from it contains about 16 per cent. of fat; if it stands six hours, the upper 6 ounces contain about 12 per cent. of fat; if for three hours, the upper 10 ounces has about 8 per cent. of fat. In top-milk thus removed the sugar may

be considered as 4 per cent. and the proteids as nearly 4 per cent. In this way one may obtain for dilution cream-milk mixtures containing any of the required percentages of fat.

MILK-SUGAR SOLUTIONS.—Since lactose must be added, it is convenient to add the sugar to the water, thus making a milk-sugar solution. Boiling water should be used, and if the solution is not clear it should be filtered through absorbent cotton. The solution should be made fresh daily in warm weather; in cold weather it will keep for two days.

The table shows the amounts of milk-sugar and water required to make the standard solutions:—

STRENGTH OF SOLUTION.	AMOUNT OF MILK-SUGAR.	BOILING WATER.
4 per cent.	1 ounce	25 ounces
5 per cent.	1 ounce	20 ounces
6 per cent.	1 ounce	16 $\frac{2}{3}$ ounces
7 per cent.	1 ounce	14 ounces
8 per cent.	1 ounce	12 $\frac{1}{2}$ ounces
10 per cent.	1 ounce	10 ounces

[A small box holding exactly 1 ounce of milk-sugar may be gotten from any druggist. An even tablespoonful contains about 3 $\frac{1}{2}$ drachms of milk-sugar; so that, for an approximation, a tablespoonful of milk-sugar to each 8 ounces of the food adds 5 per cent. to the sugar ingredient. L. EMMETT HOLT and L. E. LA FETRA.]

Preparation of the Food for Healthy Infants.

Whereas it is impossible to give simple rules by which every infant can be successfully fed, still experience shows that average infants under one year old may be fed according to a schedule arranged for certain periods. The schedule applies to healthy infants of average weight, under average conditions, and is meant to serve as a general guide, not to be blindly followed, for varying circumstances will modify any plan of feeding.

FIRST PERIOD: FROM BIRTH TO THE END OF THE FOURTH MONTH.—In making up the food for this period experience shows that the best results for an average child are obtained when the *fat* in the formula is approximately *three times the amount of the proteid*: practically the ratio in breast-milk. Such a proportion may be obtained by using a cream-milk mixture in which the fat amounts to 12 per cent. This 12-per-cent. cream-milk mixture can be gotten by taking (a) equal parts of light centrifugal cream and dairy milk, or (b) 2 parts of gravity-cream and 1 part milk, or (c) the upper 6 ounces of a quart of milk after standing on ice for 6 hours.

1. For the *second, third, and fourth days* of life the formula should be: fat, 1.0 per cent.; sugar, 4.0 per cent.; proteids, 0.33 per cent. This may be made by taking $1\frac{1}{4}$ ounces of 12-per-cent.-cream-milk mixture, $13\frac{1}{4}$ ounces of 4-per-cent.-sugar solution, and $\frac{1}{2}$ ounce of lime-water.

The schedule for the number and intervals of feedings, with the amount at each feeding during twenty-four hours, is given on page 690.

2. For the *fifth, sixth, and seventh days* the formula should be: fat, 1.5; sugar, 5.0; proteids, 0.5 per cent. This may be made by taking $2\frac{1}{4}$ ounces of 12-per-cent. cream, 15 ounces of 5-per-cent.-sugar solution, and $\frac{3}{4}$ ounce of lime-water.

3. For the *second week* the formula should be: fat, 2.0; sugar, 6.0; proteid, 0.6 per cent. There are required, to make 18 ounces of this food: 3 ounces of 12-per-cent. cream, $14\frac{1}{4}$ ounces of 6-per-cent.-sugar solution, and $\frac{3}{4}$ ounce of lime-water. For 30 ounces, take 5 ounces of 12-per-cent. cream, $23\frac{3}{4}$ ounces of 6-per-cent.-sugar solution, and $1\frac{1}{4}$ ounces of lime-water.

4. For the *third and fourth weeks* the formula should be: fat, 2.5; sugar, 6.0; and proteids, 0.8 per cent. Twenty ounces of this formula may be made by taking 4 ounces of 12-per-cent. cream, 15 ounces of 6-per-cent.-sugar solution, and 1 ounce of lime-water. To make 32 ounces, take $6\frac{1}{2}$ ounces of 12-per-cent. cream, 24 ounces of 6-per-cent.-sugar solution, and $1\frac{1}{2}$ ounces of lime-water.

5. For the *second and third months* the formula should be: fat, 3.0; sugar, 6.0; and proteids, 1.0 per cent. To make 24 ounces of this formula there are required 6 ounces of 12-per-cent. cream, $16\frac{3}{4}$ ounces of 5-per-cent.-sugar solution, and $1\frac{1}{4}$ ounces of lime-water. To make 36 ounces take 9 ounces of 12-per-cent. cream, $25\frac{1}{4}$ ounces of 5-per-cent.-sugar solution, and $1\frac{3}{4}$ ounces of lime-water.

6. For the *fourth month* the formula should be: fat, 3.6; sugar, 7.0; proteids, 1.2 per cent. To make 25 ounces of this formula take $7\frac{1}{2}$ ounces of 12-per-cent. cream, $16\frac{1}{4}$ ounces of 6-per-cent.-sugar solution, and $1\frac{1}{4}$ ounces of lime-water. To make 38 ounces take $11\frac{1}{2}$ ounces of 12-per-cent. cream, $24\frac{1}{2}$ ounces of 6-per-cent.-sugar solution, and 2 ounces of lime-water.

SECOND PERIOD: FROM BEGINNING OF FIFTH TO END OF NINTH MONTH.—During this period the best results are obtained by using formulæ in which the *fat is about twice the proteid*. This proportion exists in the 8-per-cent.-cream-milk mixture which is used as the basis for modification during this period. The 8-per-cent. cream may be obtained by taking (a) 1 part of light centrifugal cream and 3 parts of milk, or (b) 1 part gravity cream and 2 parts of milk, or (c) the upper 10 ounces from a quart of

milk which has stood on ice for 4 or 5 hours.

1. For the *fifth month* the formula should be: fat, 3.6; sugar, 7.0; and proteids, 1.8 per cent. Thirty ounces of this food may be made by taking $13\frac{1}{2}$ ounces of 8-per-cent. cream, 15 ounces of 6-per-cent.-sugar solution, and $1\frac{1}{2}$ ounces of lime-water. To make 40 ounces of this formula take 18 ounces of 8-per-cent. cream, 20 ounces of 6-per-cent.-sugar solution, and 2 ounces of lime-water.

2. For the *sixth, seventh, eighth, and ninth months* the formula should be: fat, 4.0; sugar, 7.0; and proteids, 2.0 per cent. Thirty-six ounces of this formula may be made by taking 18 ounces of 8-per-cent. cream, $16\frac{1}{4}$ ounces of 5-per-cent.-sugar solution, and $1\frac{3}{4}$ ounces of lime-water. To make 42 ounces, take 21 ounces of 8-per-cent. cream, 19 ounces of 5-per-cent.-sugar solution, and 2 ounces of lime-water.

THIRD PERIOD: FROM THE TENTH TO THE FIFTEENTH MONTH.—During this period the best results are secured by having the *fat and the proteids approximately equal*, as they are in whole milk. With the whole milk during this period there should be combined some kind of farinaceous food. From the beginning of the tenth month to the end of the first year the proportions should be two-thirds dairy-milk and one-third of a moderately-thick gruel. After the infant is a year old the proportions may be changed to three-fourths milk and one-fourth of a thicker gruel.

PREPARATION OF THE DAILY SUPPLY.

—The full quantity of food for twenty-four hours should be made at one time; then clean bottles for the required number of feedings are filled, stoppered with non-absorbent cotton, and sterilized,

pasteurized, or, if the food is to be used raw, placed immediately on ice.

Of the many hundred marasmic and rachitic infants observed, it is believed that fully 95 per cent. had been fed on the meal-foods or on condensed milk, chiefly the latter. In order to make up the deficiency of fats and proteids in condensed milk, cream may be added in proportion to make up the deficient fat. Among dispensary patients codliver-oil supplies the deficiency, the dose varying with the age of the baby, the ability to digest it, and the season of the year. Ten drops to a dessertspoonful, three or four times daily after feeding. During very hot weather the dose must be reduced or suspended if there are evidences of gastro-intestinal disturbance.

The low proportion of proteids may be increased by adding a meat-broth. One pound of lean beef is boiled in one quart of water till the liquid is reduced to one pint. Such a broth contains 0.8 per cent. proteids; so that if 1 part of condensed milk is added to 12 of broth the mixture will contain 0.5 per cent. of fat, 1.4 per cent. of proteids, and 4 per cent. of sugar. This will answer for a child three months old, fat being supplied by codliver-oil. When the sixth month is reached 1 part of condensed milk may be added to 9 of broth. The percentages then will be, approximately, 0.75 per cent. of fat, 1.7 per cent. of proteids, and 5 per cent. of sugar. This, with codliver-oil, will answer until the eighth or ninth month, when barley- and oatmeal- gruel, with other meal mixtures, may be allowed. Kerley (*Med. News*, vol. lxx, No. 23, '97).

The number of children over four months of age who are fed exclusively on condensed milk are "an ill-conditioned class of children with their starved muscular and nervous systems and catarrhal tendencies, who fall an easy prey to broncho-pneumonia in the winter, to the gastro-intestinal diseases in the summer, and to the infectious diseases during the entire year." The chief objection to condensed milk as an infant-food is the fact that it contains a slight deficiency of proteids and an excessive and almost

fatal deficiency of fat. Condensed milk cannot be changed or fortified so as to render it a desirable food; it may be made permissible; nevertheless, its use is not to be advised when a better food can be procured. Sometimes the practitioner is obliged to use it among the extreme poor.

One of the most frequent and serious errors in infant-feeding is overfeeding. Crandall (*Archives of Ped.*, Aug., '97).

For home-modification of milk, Soxhlet, of Munich, has devised a formula which has proved of value in most cases. This can be made by diluting the milk coming from a very good dairy $\frac{1}{2}$ with water, for a child below nine months, and adding to each 8 ounces a teaspoonful of sugar of milk, dissolving the sugar of milk first in the 4 ounces of water, and then adding the 4 ounces of milk. Below three months the children should be given 3 ounces in each bottle, and 8 bottles in 24 hours. Henry Koplik (*N. Y. Med. Jour.*, Apr. 23, '98).

Following requirements given for a perfect modified milk: (1) alkalinity and body-temperature, (2) sufficient quantity, (3) proper proportion of constituents, (4) digestibility, (5) freshness, sterility, and cleanliness, (6) absence of adulteration. Edward Hamilton (*Amer. Jour. of Obst.*, etc., Aug., '98).

It is of great importance to increase the percentage of proteids in the milk as rapidly as the infant can digest it, but also to avoid commencing with too high a percentage. One should begin with only 0.25 or 0.5 per cent. of proteids, and increase it rapidly, so that, in many instances, the food will contain 1.5 per cent. of proteids at the end of the first six weeks. This is the key-note to success in the artificial feeding of infants. L. Emmett Holt (*Phila. Med. Jour.*, Mar. 24, 1900).

Bottles and Nipples.—Graduated cylindrical bottles, with wide mouths, are generally preferred, being easily cleansed. The best nipples are those of plain black rubber which slip over the neck of the bottle. On no account should a nipple with a long rubber tube be used. The hole in the nipple should

not be large enough to let the milk run in a stream when the bottle is inverted. Bottles should be boiled before the food is put into them; and both bottles and nipples thoroughly washed after use. Nipples should be kept in a borax or boric-acid solution.

The feeding question is at the root of the great mortality of infants; but of almost equal importance to the health of the child is the receptacle from which it takes its nourishment, viz.: the nursing-bottle. A bottle furnished with a long rubber tube has been justly condemned, as it is an impossibility to keep the tube clean; and, therefore, the child draws impurities into the mouth, which, on account of its warmth and moisture, is one of the most prolific parts of the human anatomy for the propagation of every species of microbe. Henri de Rothschild (*Med. Times*, July, '98).

The difficulty experienced in feeding by means of a spoon children with cleft palate in the hospitals led to personal device of a nipple which would obviate this. The modification in the nipple consists in the attachment of a "wing" of sheet rubber, which fills the cleft during the act of suckling. With the ordinary rubber nipple this device does not work well, because of the collapse of the nipple. By putting the attachment on the "non-collapsible nipple" the desired object is accomplished. S. Lloyd (*Pediatrics*, Mar. 1, 1901).

Rules for Artificial Feeding.

The rules as to frequency and regularity of feedings are more important with bottle-fed than with nursing babies. The table given below will serve as a guide. Just before feeding the food is heated to body-temperature by placing the bottle in a vessel of hot water; a bottle should not be warmed over for a second feeding. Twenty minutes is long enough for a feeding; no child should be allowed to sleep with the nipple in its mouth.

As the milk enters the child's mouth from the breast of the mother, its tem-

perature is always below 98° F. It usually varies from 96.5° to 97° F. It is evident that milk given to children should not be heated above these temperatures. Smester (*Maladies de l'Enfance*, No. 15, '97).

The first essential in the artificial feeding of infants is to have a definite plan upon which to go and to avoid haphazard procedures. Diluted cows' milk, condensed milk, and peptonized milk may be regarded as the positive, comparative, and superlative of digestibility respectively, and should be tried in that order until the digestive power of the child is suited, due regard being paid to the details of administration. Periodic weighing of the child is the only test of the success or failure of the food selected. In cases in which even peptonized milk fails to give good results, great benefit often follows the administration of gray powder, even in cases in which there is no reason to suspect a syphilitic taint. In spite of all care and the use of the above methods, there remains a residuum of cases in which progressive wasting persists. Many of these seem to be babies who are unable to digest the casein of cows' milk in any form. In such a case one should try to procure a wet-nurse for the child, and failing that, one must eliminate casein from the diet by making whey the basis of the feeding mixture. The use of a patent food as the sole article of diet for a baby is rarely, if ever, necessary, so long as cows' milk can be obtained, either fresh or condensed. If a child is unable to digest much cows' milk it is often worth while to try the effect of adding a little starchy food to the diet, even at an early age, for inability to

digest milk appears to be sometimes accompanied by an unusual capacity for the conversion of starch. R. Hutchison (*Lancet*, Sept. 1, 1903).

Schedule for feeding healthy infants during the first year appears below.

The Use of Other Substances than Milk during the First Year.

Besides the ingredients of modified milk, the only other foods to be given during the first year are beef-juice and the fruit-juices.

BEEF-JUICE may be added to the diet at about the tenth month. At first 1½ ounce is given, either alone or with the milk; the amount may be increased up to 2 or 3 ounces daily, given at two or three feedings.

FRUIT-JUICES.—Strained orange-juice is the most useful of the fruit-juices, and may be added by the eleventh or twelfth month. It is best given about an hour before the feeding: 1½ to 1 or 2 ounces at a time. The fruit-juices are particularly useful in constipation.

Indications for Special Modifications.

I. FLATULENCE AND HABITUAL COLIC.

—These symptoms are almost invariably due to difficulty in the digestion of the proteids. The cause of this difficulty may be either that the proteids are too high or that the child has a feeble digestion as regards proteids. There are three methods of overcoming the difficulty: first, by reducing the proportion of proteids; second, by partly

AGE.	NO. OF FEEDINGS IN 24 HOURS.	INTERVAL BETWEEN MEALS BY DAY.	NIGHT-FEEDINGS (10 P.M. TO 7 A.M.).	QUANTITY FOR ONE FEEDING.	QUANTITY FOR 24 HOURS.
Third to seventh day	10	2	2	1 to 1½ ounces	10 to 15 ounces
Second and third weeks	10	2	2	1½ to 3 ounces	15 to 30 ounces
Fourth and fifth weeks	9	2	1	2½ to 3½ ounces	22 to 32 ounces
Sixth week to third month	8	2½	1	3 to 4½ ounces	24 to 36 ounces
Third to fifth month	7	3	1	4 to 5½ ounces	28 to 38 ounces
Fifth to ninth month	6	3	0	5½ to 7 ounces	33 to 42 ounces
Ninth to twelfth month	5	3½	0	7½ to 9 ounces	37 to 45 ounces

predigesting the proteids; and, third, by the addition to the milk of farinaceous substances which theoretically aid proteid digestion.

By Reducing the Proportion of Proteids.—Suppose, for example, a child of one month, taking the proper formula for that age, has colic. The proteids may be reduced without changing the percentage of sugar and fat by using a 16-per-cent. (gravity) cream instead of the 12-per-cent. cream, and making a higher dilution with the sugar solution. Or, again, a child of six months may be taking 4-7-2, and suffer from flatulence and colic. The proper treatment is to return to one of the earlier formulæ,—as 3-6-1.

It must be kept in mind, however, that, after each change of formula to a higher proteid, there may be a slight amount of colic and flatulence for a day or so; one should not, therefore, be discouraged and go back to a lower percentage until a fair trial of the higher proportion has been made.

By Partly Peptonizing the Food.—At first the food may be peptonized for an hour, preferably just before the feeding-time; later the process may be shortened to fifteen or even ten minutes. The use of the peptonizing tubes is most satisfactory; but a somewhat similar result is produced by using the peptogenic milk-powder. Peptonized milk should not be given for a longer period than absolutely necessary,—never, if possible, longer than three months,—lest the child gradually lose its ability to digest proteids. It must be remembered that, even with peptonizing as an adjunct, a proper formula is essential.

By Adding Farinaceous Substances to the Food.—Experience indicates very clearly that many children can manage the proteids of cows' milk more easily

when some farinaceous substance in the form of gruel is added to the food; and that many of the signs of proteid indigestion—flatulence, colic, etc.—are relieved by this addition.

Personal experiments showing that it is possible to cause a marked decrease in nitrogen elimination, or an increase in nitrogen retention, by adding carbohydrates to the food. Arthur Keller (Centralb. f. Inn. Med., Jan. 14, '99).

In practice the simplest way to add carbohydrates to the nourishment is to use a gruel made of barley, oatmeal, or wheat to replace part or all of the water of the formula. Barley-gruel is the one most employed, and is easily made by boiling one tablespoonful of barley-flour in a pint of water for twenty minutes. This may be used to replace half the water in any of the foregoing formulæ, and it usually influences not only the intestinal colic, but also has a marked effect on flatulence in the stomach. The gruel made from oatmeal is preferable if there is constipation; that made from barley- or wheat- flour if there is diarrhœa.

The milk is manipulated too much in the laboratories. One obtains by this method 3 or 4 per cent. of fat, but the fat is not in a fine emulsion, and clinically the fat, in order to be thoroughly assimilated, must be in a fine emulsion. Many babies, not assimilating the casein, will improve by using a thin barley-water that has been malted. Henry Dwight Chapin (N. Y. Med. Jour., Apr. 23, '98).

II. CURDS IN THE STOOLS. — This symptom has the same causes as flatulence and colic, and the dietetic treatment is the same.

It is of paramount importance to know:—

1. The chemical reaction of the alvine discharges: *i.e.*, whether acid or alkaline. If the reaction is excessively acid, this is due to the carbohydrates; if very alkaline we may infer that this is due to the ingestion of the albuminous foods.

2. The color. If this be green, we may infer that the infant has eaten too much of the albuminous foods or has taken its milk too fast.

3. Odor. If this is scarcely perceptible, or slightly sour, the cause is certainly the starchy foods, while if very offensive it must be due to the proteid foods.

4. Consistence. If the discharge is very thin, with little mucus and no blood and not very frequent action, this would indicate that the seat of the trouble is in the small gut; while if the consistence is somewhat heavier and the discharge contains mucus with perhaps some blood, accompanied by tormina and tenesmus, the lesion is in the colon.

5. Digestion. If solid particles are seen we may at once determine what food to withhold.

6. Constitutional symptoms. If there is a high temperature, it is certainly due to the albuminous foods. J. F. Kahler (Med. Rec.; Med. World, Aug., '98).

III. VOMITING.—If shortly after feeding, the regurgitation is generally to be remedied by diminishing the quantity or the frequency of the feedings, or both. If the vomiting occurs an hour or so after a feeding it is often due to too much fat, and the fat should be reduced. For example, if an infant taking 3-6-1 vomits between feedings it would be well to change the formula to 2-6-1. This formula can be made by taking 8-per-cent. cream and diluting with 3 parts of 5-per-cent.-sugar solution; moreover, any formula in which the fat percentage is twice the proteids may be obtained by diluting the 8-per-cent. cream.

In some conditions of slow stomach-digestion it is better to feed every three or four hours, instead of every two or two and a half hours.

IV. LOSS OF APPETITE.—The indication is to make the intervals of feeding longer, the quantity smaller, and the food more dilute; this applies particularly to the fat. The symptom indicates

feeble digestion, for the time being, and can best be treated by greatly reducing the amount of work required.

V. CONSTIPATION.—This is a frequent symptom, and is always hard to control. The difficulty often is that there is insufficient residue, and this is to be overcome by increasing the proportions of all the ingredients. A second cause is too small a percentage of fat; but it is seldom advisable to increase the fat above 4 per cent., because of constipation.

Too often the constipation depends on bad habits rather than on anything wrong with the food; so that early training is of prime importance.

VI. DIARRHŒA.—A diarrhœa which has as a cause simply a wrong proportion in the food is very rare. Frequent almost normal movements, however, may be due to too high fat. Generally the diarrhœa is due to acute or subacute indigestion in the intestines.

Buttermilk used with success for years as a food for infants. He adds rice and barley to it, and heats it for twenty-five minutes, after which he adds beet-sugar. As a result of the use of buttermilk, acute and chronic gastro-enteritis disappear and rachitis is seldom seen. The lactic acid does no harm and but very little free hydrochloric acid results. No case of infantile scurvy has ever appeared. It is not indicated during the first month of life. Vomiting grows less or stops entirely, and diarrhœa is never caused by it. When constipation exists, or the child ceases to gain in weight, cows' milk may be added to the buttermilk. Teixeira de Mattos (Jahrbuch f. Kinderh., Jan., 1902).

Lauded by the Dutch physicians and prepared according to their prescriptions, buttermilk is a good therapeutic aliment for infants affected with acute or chronic diseases. The buttermilk used in the author's experiments contained cream rendered acid by the lactic acid fermentation, and freed from the

greater part of fatty matter by the extraction of butter. It was delivered as fresh as possible and the cream exposed no longer than twenty-four hours to the lactic acid fermentation. It was then treated as follows: To a litre of buttermilk there were added 25 grains of wheaten flour and 35 grains of cane-sugar. It was then put to boil for at least two minutes, mixed continually, and allowed to boil over three or four times. It was then placed in bottles previously sterilized in boiling water, stoppered with sterilized corks, and placed in the refrigerator. Before serving it was raised in the water-bath to the body-temperature. Thus prepared, buttermilk seems to represent *à priori* no less than the equivalent, from the chemical standpoint, of the ideal nourishment of the infant. It is well borne sometimes after the acute crises of dyspepsia and diarrhoea with vomiting. Employed as an aliment and as a remedy, it can absolutely save lives of infants attacked with chronic diseases of the stomach and intestines. As to its utility when employed as a food for a long time, it is not possible to say until a greater number of observations have been made. Neither rickets nor scurvy has been observed following its prolonged use. A. Baginsky (Revue d'Hyg. et Méd. Infantiles, Oct., 1902).

Series of clinical tests of buttermilk as a food for 119 infants of nursing age. The milk used was recovered from sour cream, and contained 2.5 per cent. of albumin, 0.5 to 1 per cent. of fat, and from 3 to 3.5 per cent. of sugar. The acidity equaled 7 cubic centimetres ($1\frac{3}{4}$ fluidrachms) of normal NaOH for each 100 cubic centimetres ($3\frac{1}{3}$ fluidounces) of buttermilk. The milk should be used within twenty-four hours after churning, and must be obtained from a reliable source. The ordinary buttermilk of the shops is unclean and dangerous. The buttermilk used in Hebner's clinic is prepared as follows: Fifteen grains (1 gramme) of wheat-flour are stirred up with a tablespoonful of cold buttermilk; the remainder of the buttermilk is then added, together with 2 ounces (60 grammes) of sugar. This preparation is

slowly heated, being meanwhile constantly stirred; the milk is allowed to boil up in about fifteen minutes, and is then poured into previously sterilized bottles, closed with rubber stoppers. Further sterilization is unnecessary. The nutritive value of this mixture is very high, being 714 calories per litre. Most infants readily accept this food, either alone or alternately with "malzsuppe" or with human milk. The stools of infants so fed are normally of moderate volume, slight odor, neutral or slightly alkaline reaction, homogeneous, and yellow. The absorption which occurs is estimated at 90 per cent. of albumin and 93 per cent. of fat. Buttermilk was tested with satisfactory results as the first food given after acute digestive disturbances. Among 119 cases the results of buttermilk feeding were satisfactory in 85 instances. Of the 34 infants who did not thrive on this diet, only 4 were successfully nourished by other means; 30 failed to do well on any other diet, several going into decline even when intrusted to wet-nurses. In large clinics the low price of buttermilk is an important consideration. B. Salge (Jahr. f. Kinderh., Bd. lv, S. 1).

VII. FAILURE TO GAIN IN WEIGHT.

—This symptom, in a child with a good appetite and good digestion, means insufficient nourishment. The quantity of the food should first be increased, and then the proportions of fat and proteids gradually raised, so as not to disturb the digestion.

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NUX VOMICA.—Nux vomica (poison-nut, Quaker button, semen strychni) is the seed of *Strychnos nux-vomica*, a tree (nat. ord., *Loganiaceæ*) growing in the East Indies, Cochin China, and neighboring countries. All parts of the tree are bitter and poisonous. The seeds are disk-shaped, about an inch in diameter, covered with silky hairs, of a greenish-gray color, and grayish white internally. They

are very tough and are reduced to powder with difficulty. They are without odor, but are very bitter to the taste. The seeds contain the alkaloids strychnine ($\frac{1}{4}$ to $\frac{3}{5}$ per cent.), and brucine ($\frac{1}{8}$ to 1 per cent.) in combination with igasuric (strychnine) acid, and also the glucoside loganin, a yellow coloring matter, a concrete oil, gum, starch, wax, and earthy phosphates. The powdered drug varies in alkaloidal strength, and in using the preparations it is necessary to have them standardized to insure uniformity of physiological and therapeutic effect.

Brucine, one of the alkaloids found in *Strychnos nux-vomica*, and also in *Strychnos Ignatii*, occurs as a light, white, crystalline powder, soluble in 850 parts of water, and more soluble in alcohol ($1\frac{1}{2}$ parts) and in chloroform. It is with difficulty separated from strychnine, in many samples of which it is present as an impurity. In effect it is one-twelfth as powerful as strychnine, and one-third as quick. The dose is $\frac{1}{10}$ to $\frac{1}{2}$ grain; maximum daily dose is 3 grains.

Strychnine will be considered alone, in its proper place; although it is the representative alkaloid of nux vomica, it has, however, its own peculiar field of usefulness.

Ignatia may claim our attention here on account of its close resemblance to nux vomica, not only as to its alkaloidal constituents, but also on account of the similarity of its physiological action and therapeutic uses. Ignatia (bean of St. Ignatius) is the seed of the *Strychnos Ignatii*, a tree indigenous to the Philippine Islands, where the seeds were used as a medicine by the natives. The Jesuit missionaries named it in honor of the founder of their order. The seeds of ignatia yield a larger proportion of strychnine, brucine, and igasuric acid

than can be obtained from nux vomica. Tincture of ignatia may be given in doses of 1 to 15 minims in all diseases in which nux vomica is indicated.

Preparations and Doses.—Nux vomica (powdered nut), 1 to 4 grains.

Extractum nucis vomicæ, $\frac{1}{4}$ to 1 grain.

Extractum nucis vomicæ fluidum, 1 to 4 minims.

Tinctura nucis vomicæ, 5 to 15 grains.

Physiological Action.—The physiological action of nux vomica is that of its principal alkaloid, strychnine, and will be reviewed at length when the latter is considered (see STRYCHNINE).

Poisoning by Nux Vomica.—In 10 to 20 minutes after the poison is ingested the first symptoms usually appear. General uneasiness and restlessness are followed by a feeling of suffocation. The muscles twitch and the head and limbs begin to jerk. Later, violent tetanic convulsions come on, which soon involve the whole body. The face is drawn into a grin (*risus sardonicus*), the lower jaw becomes fixed, the neck rigid, the pupils dilated, the reflexes heightened, then paroxysmal attacks of tonic contraction occur, at intervals varying from five minutes to half an hour, especially of the extensor muscles of the body, producing opisthotonos. The eyeballs become prominent; the respiration is impeded, from tetanic spasm of the respiratory muscles; and the face becomes livid. The paroxysm may last from a half-minute to several minutes, when it subsides and is followed by a period of relaxation during which the patient is bathed in perspiration and is utterly prostrated. The paroxysm returns in a few minutes, being precipitated by the slightest cause—a breath of wind, a slight noise, an effort to move, or an attempt at being fed. The paroxysm increases in fre-

quency and violence, the pulse becomes feeble and rapid, and death results usually after four or five hours from asphyxia or collapse, the mind remaining clear to the last. The fatal dose is generally stated to be 30 grains of the powdered nut, the weight of one seed, 3 grains of the solid extract, or 3 grains of strychnine; but $\frac{1}{16}$ grain of strychnine has proved fatal in a child and $\frac{1}{4}$ grain in an adult.

Treatment of Poisoning by Nux Vomica.—The immediate use of emetics and of the stomach-pump, if the lock-jaw permit it, is indicated. The use of chloroform may overcome the lock-jaw and benefit the patient in other respects. Animal charcoal and tannic acid may be given *ad libitum*, followed by an emetic. Thirst may be relieved by strong tea. The catheter should be used when required. Absolute quiet, so far as possible, should be maintained. Bromides in large doses, chloral, amyl-nitrite, curare, morphine, and atropine may prove efficient antidotes. The antidotes may be given by the rectum; artificial respiration is sometimes indicated.

Case of a woman who died in two hours after taking 6 drachms of the tincture of nux vomica, representing $\frac{3}{4}$ grain of strychnine. The pupils were widely dilated, and unconsciousness came on three times. Apomorphine failed to produce vomiting. The exhibition of chloroform to arrest convulsion gave rise to dangerous symptoms. H. D. Hale (Brit. Med. Jour., July, '99).

Therapeutics.—Nux vomica may be employed as a simple, bitter tonic; as a special tonic in diseases of the nervous system; or as a respiratory, cardiac, or ocular stimulant. Care should be exercised when giving nux vomica or its preparations to children, as a small dose influences them profoundly.

The only contra-indications to nux vomica in children are those in which

there is marked reflex excitability of the nervous system. Comby (La Méd. Mod., Mar. 28, '96).

GASTRO-INTESTINAL DISORDERS.—The preparations of nux vomica, like other bitters, produce a sensation of hunger, and, on account of an inherent slight irritant action upon the gastric mucous membrane, increase the digestive secretions and thereby promote digestion. They are found useful in cases of debility, and in convalescence, where the tongue is more or less coated and the digestion weak. One or two drops of the tincture in a teaspoonful of water every two hours or oftener, for twenty-four to forty-eight hours, will clear the tongue, improve the digestion, and prepare the way for stronger tonics and more liberal diet (Ringer).

Flatulence and heart-burn generally yield to small doses of the tincture given three or four times daily. In acute gastric catarrh accompanied by sick headache, but without much nausea, due generally to some error in diet or to constipation, prompt relief is obtained from nux vomica. One drop of the tincture in a teaspoonful of water every five or ten minutes, for eight to ten doses, and then continued at longer intervals, will often mitigate this kind of headache, and in a few hours remove it, when otherwise it would have continued severe all day (Ringer). In chronic gastric catarrh and the morning sickness of drunkards, nux vomica is next in value to arsenic; it is best given with the mineral acids (Bartholow). The poor appetite, feeble digestion, and the nervousness and trembling which follow the sudden withdrawal of alcoholic stimulants are relieved by frequent, small doses of the tincture. To diminish the craving for stimulants and sustain the nervous system, Bartholow advises 5 drops of the

tincture combined with 15 drops of the tincture of capsicum, given every four hours. Intestinal indigestion and flatulence may be removed by the tincture of nux vomica. Atonic dyspepsia, due to a paretic condition of the muscular coat of the bowel, is relieved by this drug in combination with other appropriate remedies.

In constipation nux vomica is a useful addition to purgatives, for its stimulating and tonic effect upon the muscular coat of the bowel. In some forms of epidemic dysentery this drug is indicated where there is a depressed condition of the vital forces associated with tympany and prune-juice stools.

In the threatening collapse of cholera, nux vomica combined with opium and the mineral acids is indicated; it is also useful as a prophylactic during the preliminary diarrhœa.

In summer diarrhœa where the stools are watery and in colliquative diarrhœa the same combination is efficient; if much pain be present, the quantity of opium may be increased or a double dose given at first. Bartholow suggests the following:—

R Strychninæ sulph., $\frac{1}{4}$ grain.
Acidi sulphurici dil., \mathfrak{z} ss.
Morphinæ sulph., gr. ij.
Aq. camph., \mathfrak{z} iiiss.

M. Sig.: A teaspoonful every hour or two, well diluted.

UTERINE DISORDERS.—The neuralgic form of dysmenorrhœa is permanently removed by the administration of nux vomica during the intervals. Nux vomica is given in many cases of amenorrhœa for its tonic action on the pelvic viscera. In post-partum hæmorrhage Fordyce Barker's well-known formula is: Tincture of nux vomica, 20 drops; fluid extract of ergot, 30 drops; to be given every half-hour until the uterus is well contracted.

Not more than two or three doses of this would be necessary or safe.

BLOOD DISORDERS.—Nux vomica is useful to improve the quantity of impoverished blood, as it stimulates the blood-making organs. Combined with iron and quinine, it is of great value in anæmia, chlorosis, purpura, and in the hæmorrhagic diathesis. In intermittent fever it is employed as an adjuvant to quinine.

NERVOUS DISORDERS.—In impotence due to mere relaxation and atony of the erectile tissue, and not to organic effects, nux vomica is indicated. Incontinence of urine, when due to a paretic state of the sphincters, may sometimes be cured by nux vomica. Nocturnal incontinence—when not relieved by belladonna, ergot, and iron—may be benefited by nux vomica. Amaurosis either from lead poisoning or from the abuse of alcohol or tobacco may be cured by this drug. Eye-strain from insufficiency of the ocular muscles yields readily to the influence of nux vomica. De Schweinitz advises the use of ascending doses of the tincture, beginning with 3 drops, three times daily until distinct physiological effects are produced. Sometimes 60 drops may be taken in twenty-four hours after tolerance is reached.

After the occurrence of brain lesions this drug is useful to maintain the nutrition of the paralyzed member. It is not safe, however, until after repair of the lesion, nor useful if electrical reaction is absent.

PULMONARY DISORDERS.—Nux vomica is useful in dyspnœa dependent upon winter cough, bronchorrhœa, emphysema, and phthisis. It is a valuable stimulant in pneumonia, when collapse threatens.

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O

OBSTRUCTION, INTESTINAL (ILEUS).

Definition.—A complete or partial occlusion of any portion of the intestinal canal, caused by strangulation, intussusception (invagination), twisting or knotting (volvulus), strictures, tumors, fæcal impactions, concretions, or foreign bodies. The occlusion may occur suddenly, causing *acute obstruction*, or be of gradual development and but reduce the diameter of the intestinal canal: *chronic obstruction*. An acute obstruction may become chronic and a chronic case may become acute; it is, therefore, sometimes difficult to determine accurately the condition which we have to deal with, for one form may take on a few or many of the symptoms of the other (Keen).

General Symptomatology. — **ACUTE OBSTRUCTION.**—Colicky pains coming on suddenly after a more or less prolonged period of constipation and nausea are the earliest symptoms witnessed in the majority of cases. At first paroxysmal, the pain soon becomes continuous, the suffering increasing steadily in severity. Nausea is soon followed by vomiting, which also increases in severity until it constitutes a most distressing symptom. The contents of the stomach are first voided; this is followed by a greenish fluid stained with bile, which becomes brown, and finally stercoraceous, emitting the characteristic fæcal odor. Constipation is persistent, though bloody mucus and a small quantity of fæcal matter (that below the obstruction) may be discharged *per anum*. There is distension of the abdomen with tympanitic resonance; this constitutes the most constant of the local signs. This abdomen is very sensitive to the touch when the case has progressed some time. Bor-

borygmus and gurgling may be detected on auscultation.

The general symptoms indicate the grave character of the disease present. The features are pinched and the entire surface cold and clammy, the temperature being subnormal. The eyes are sunken; a bluish-black tinge around them and beneath the nostrils gives the face a cadaverous expression. Thirst is usually marked, and the mouth and tongue are dry. The pulse is rapid and feeble and sometimes irregular, the breathing being correspondingly more frequent. The urine is scanty and high colored; in some cases there is anuria. Finally all the evidences of imminent collapse appear, and the patient, if unrelieved, passes into coma. Death may occur in from two to six days after the first manifestations.

Two cases of asphyxia from vomiting in intestinal obstruction, in both of which the patients, suffering from acute symptoms of obstruction, vomited in the early stages of the anæsthesia such enormous quantities of fluid as to interrupt respiration. J. Ernest Stokes (*Annals of Surg.*, Sept., '97).

Obstruction of the small intestine is more likely to cause severe shock than that of the colon.

In case obstruction is complete, pain will be constant, yet periods of intensified suffering will repeatedly come on. If the obstruction is only partial, the liquid contents and gases will be forced past the constriction, and for a time the peristaltic pains will subside and the patient will be free from suffering until more gas is generated or another reflex wave is excited. In intussusception the constriction, early in the case, is usually incomplete, hence the pain is not so severe; there is no tenderness on pressure, and sometimes firm pressure relieves the pain. Many cases of obstruction develop septic peritonitis. A. H. Cordier (*Jour. Amer. Med. Assoc.*, Feb. 4, '99).

CHRONIC OBSTRUCTION.—In chronic obstruction, the most frequent cause of which is fæcal impaction, obstinate constipation usually follows a prolonged period during which the intestinal functions were characterized by great irregularity—several days' constipation perhaps followed by the elimination of hardened masses, presenting various shapes, round balls resembling the fæces of small herbivorous animals, sheep, rabbits, etc., or softer matter, ribbon or pencil shaped, the mass remaining within the intestine and obstructing it presenting a channel through which the fæces passed are molded. Mucus is also voided, sometimes in large quantities.

These symptoms may be accompanied by other insignificant general ones—perhaps a slight headache and a feeling of distension; but, when the obstruction becomes marked, then those recalling acute obstruction appear: abdominal pain, vomiting, abdominal distension, borborygmus, etc. The peristaltic action of the intestine may be easily discerned, not only by the hand, but visually. Palpation sometimes makes it possible to distinctly locate the impacted mass through the abdominal walls.

These attacks may recede—generally through successful efforts to move the intestines by injections, salines, etc., to which the patient has become habituated, but they finally become frequent, the patient gradually becoming emaciated and anæmic until unconquerable occlusion occurs, when the case becomes, in point of severity, one of acute obstruction, with all its attending dangers—increased to a marked degree by the gradual decline of the vital resistance of the organ involved.

In chronic obstruction due to other causes—cancer, cicatricial contraction—the symptoms do not vary much from those just enumerated, but in cases of

cancerous stricture the facies may afford an early clue to the nature of the causative disease present.

Diagnosis.—The *seat* of the impaction must first be detected—a feature presenting no little difficulty, unless, as is sometimes the case in chronic obstruction, the mass be distinctly felt through the abdominal walls. Even when this valuable sign cannot be obtained, however, inspection of the abdomen affords much information. By carefully palpating its entire surface areas of comparative resistance may be detected, or the outline of a section of intestine, the curve of the colon, for instance, can be clearly made out, sometimes as a rigid tube of large size. This may be due to spasm or to the accumulation of gases, the latter tending to indicate, when the gut is tense, that the obstruction is low down. If the obstruction is in the ascending colon or the first half of its transverse portion, it may often be made out by following the course of the gut from the cæcum. Pain is usually sharpest at the seat of occlusion.

When the occlusion appears to be situated (judging from the inflated colon) in the posterior part of the transverse portion or lower, a systematic examination should be resorted to, beginning at the anus. The anus itself may prove to be the source of trouble, or scybalous masses may be found immediately above it. Rectal examination with the finger and speculum may reveal organic obstructions located immediately above the sphincter. In intussusception the invaginated bowel sometimes reaches the anus. Enemas may be of assistance to show the extent to which the lower bowel is free, but a powerful stream may prove dangerous if cancer be present; hence a douche-bag elevated but a few feet above the patient's buttocks had better be used,

the patient lying either on the back with hips raised or on the right side, or in the genu-pectoral position. The entire colon should contain 1 1/2 gallons, but 1 gallon is about all that can usually be introduced in the adult without force and if but a smaller quantity—sometimes but a few ounces—can be introduced, the evidence may serve to strengthen the other signs. Examination by the introduction of the entire hand or by the rectal sound is not a safe procedure. Forced inflation by means of bellows or bicarbonate of soda and tartaric acid may also be tried, but not when cancer is thought to be present.

In obstruction of the colon tenesmus is frequently present, while mucus and blood are commonly passed; emaciation and general collapse do not occur as early as in occlusion of the small intestine, while the flow of urine is not greatly reduced. A digital vaginal examination sometimes affords further information.

In obstruction of the duodenum or jejunum the abdomen is not, as a rule, distended; vomiting occurs early; collapse is rapid; and the flow of urine usually ceases early. Palpation may be deceptive in this location, the portion of intestine below the seat of the obstruction often sinking into the pelvis and dragging the stenosed intestine some distance below its normal situation and beyond reach.

The sign which to personal mind is of the greatest significance in the diagnosis of intestinal obstruction is the importance of an empty rectum as suggestive of intestinal obstruction when there has been no movement of the bowels for several days. The value of this sign is much increased if cathartics and enemata have been given previously without satisfactory results. Personal attention was first called to this sign many years ago when a man about 40 years old, who had abdominal pain and had

had no movement of the bowels for three days, was seen. He had taken several doses of cathartic medicine and numerous enemata without avail. No vomiting, no fever, no abdominal tenderness or spasm, and no rise of the pulse. Digital examination was made on the ground that the trouble might be due to fæces impacted in the rectum, but no fæces were found, and the finger had a trace of blood on it when withdrawn. Two days later the man was operated upon and a complete obstruction of the bowel was found dependent upon a volvulus.

Since then a rectal examination has invariably been made in cases that suggested obstruction of the bowel, and it is felt that an empty rectum is of great importance in the diagnosis of this condition. The finding of blood is of great importance in corroborating the suspicion caused by the discovery that the rectum is free from fæces. Henry Jackson (Boston Med. and Surg. Jour., Feb. 27, 1902).

When the cæcum or the ileum is the seat of obstruction, the distension appears to involve the centre of the abdomen rather than the sides. The outline of the anterior portion of the small intestines may appear through the abdominal walls and present the "ladder pattern." The case progresses much more rapidly, fæcal vomiting occurring early.

All cases, without exception, should be examined for hernia, since fatal impaction may follow the intrusion into the external ring or the obturator foramen of a comparatively small loop of intestine.

The *nature* of the obstruction must next be ascertained.

Mechanical ileus must be differentiated from ileus due to paralysis of the afferent nerve, vascular ileus, dynamic ileus, post-operative ileus, lead-colic ileus, adynamic ileus, septic ileus, paralytic ileus, reflex ileus, strangulated hernia, irritant poisoning, and perforative peritonitis. A careful consideration of the antecedent history enables one frequently to make

an accurate diagnosis of the special variety of ileus in a given case, but too often the differential diagnosis is made by the aid of a laparotomy or a post-mortem section.

In ileus due to bands or adhesions there is usually a history of plastic peritonitis due to a hernia, a salpingitis, an appendicitis, or gall-stones; an ovariectomy, or some intra-abdominal operation that was followed by an abrasion of the endothelial coat of the intestine, and adhesions to an adjacent loop, or to an uncovered stump or pedicle that directs attention to compression from without. Post-operative dynamic ileus cannot be differentiated. In ileus due to compression of the bowel in a slit or opening, there may be a history of abdominal traumatism also.

In volvulus there is the age of the patient,—forty to sixty,—chronic constipation, and the enormous early distension of the abdomen to guide one as to the location and probable cause of obstruction.

In intussusception there is the sudden onset of symptoms during infancy,—childhood most frequently. The characteristic tenesmus and desire to evacuate the bowels, the mucoid, then mucosanguinolent stools; the marked exacerbations of peristalsis and pain; and the history of previous diarrhœa and excessive peristalsis are typical signs. A lozenge-shaped tumor can be felt; obstruction from foreign bodies usually gives a fairly clear history of gall-stones, the swallowing of fruit-pits, the imbibition of magnesia and chalk for a long time, or obstipation. D. A. K. Steele (*Annals of Surg.*, Apr., 1901).

STRANGULATION.—A history of peritonitis or abdominal injury during which adhesions were established, followed by periodical attacks of abdominal pain, suggests the presence of strangulation, especially when occurring in an adult. The active symptoms of an acute attack usually appear suddenly and may be very severe, but occasionally vomiting and even nausea do not occur; when vomiting attends the case it is apt to become

stercoraceous after the third day. The prostration is usually very marked. No tumor can be felt in the majority of cases; neither is blood or mucus passed, the constipation being absolute. There is usually but slight abdominal tympany or tenderness at first, these symptoms becoming manifest late in the history of the case.

Acute peritoneal effusion not only indicates strangulation after having excluded peritonitis, but it is a valuable aid in the differential diagnosis between peritonitis and strangulation, and is direct proof of the presence of the latter lesion. Peritonitis may be present and be increasing, and the initial dullness may be concealed by the increasing distension of the well-known paralytic character. Should, however, a rapid increase in dullness arise, becoming more marked hour by hour and clearly shown by percussion, it demonstrates the supervention of internal strangulation upon the existing peritonitis. If the case is a recent one, the large amount and rapid increase of the effusion renders the diagnosis one of strangulation. The acute nature of the effusions is also of aid. Carl Bayer (*Centralb. f. Chir.*, June 10, '99).

INTUSSUSCEPTION.—Invagination of one portion of the intestine into an adjoining portion is, as a rule, easily recognized. Palpation of the abdominal walls discloses, in most cases, a transverse elongated tumor on the right side of the middle line: a region corresponding with the portion of the transverse colon nearest the surface. The presence of this tumor, the passage of blood-stained mucus, and tenesmus are the distinctive features of this form of stenosis. Stercoraceous vomiting is frequently absent, tympany and distension likewise. Vomiting occurs early, and the prostration is generally marked. As already stated, the invaginated bowel may sometimes be detected in the rectum by digital examination. Intussusception is almost invariably met with in children.

Report of experience in fourteen personal cases. Intestinal intussusception is much more common than is generally believed, and occurs in fully 30 per cent. of all cases of acute obstruction. The use of air- and water- pressure is justifiable in all cases of less than twenty-four hours' duration, and the latter should be tried before operative measures are undertaken. Erdmann (*Annals of Surg.*, Feb., 1900).

TWISTING OR KNOTTING (VOLVULUS).

—This form of obstruction is far more difficult to recognize. It presents the main symptoms of intestinal obstruction, including preliminary constipation; but there is, as a rule, no history of tenesmus or of muco-sanguineous stools. The acute symptoms appear suddenly and are severe from the start, abdominal distension and tenderness being especially marked. Vomiting is apt to come on late, however; it is rarely stercoraceous, the lesion, in the majority of cases, being situated at the sigmoid flexure. Constipation is absolute and intestinal gases are retained. The usual position of the volvulus causes it to lie deep in the pelvic cavity, and it cannot, therefore, be felt through the abdominal walls. Occasionally the intestine is sufficiently weighted by accumulated fæces to bring it within reach of the finger in the rectum or through the vaginal wall. The passage of a flexible bougie or of fluids by injection is sometimes advised. Exploratory laparotomy is often necessary.

FÆCAL OBSTRUCTION.—Fæcal obstruction is situated, in the great majority of cases, in the rectum or the sigmoid flexure: parts habituated to the pressure of more or less large masses of fæcal matter. It is, therefore, slow of development: a chronic form. After a prolonged period of constipation—following, perhaps, a period during which small, hard, rounded masses were voided (as described under chronic obstruction)

—acute symptoms supervene, which may be suddenly relieved by a copious passage. When this does not occur, however, abdominal pain, nausea and vomiting, and gradually increasing distension follow in more or less rapid succession; and, when the vomiting becomes fæcal, collapse is imminent. Examination of the rectum by the finger or speculum quickly clears the diagnosis in most cases. Vaginal examination also assists when the impaction is somewhat high. Abdominal palpation is only of use when the accumulation is very large. This form is often met with in the insane, especially in females.

OBSTRUCTION BY STRICTURE OR COMPRESSION.—The manifestations of this form resemble those of fæcal obstruction, but there is often a history of several slight acute attacks accompanied by the passage of ribboned fæcal matter. Muco-sanguineous stools are seldom witnessed.

Strictures that are not cancerous are generally of tuberculous origin. Three varieties suggested: the purely cicatricial, the fibrous, and the hypertrophic. The latter is both of bacillary and inflammatory reaction, the latter being the seat of tuberculous invasion, which includes the mucous, submucous, and muscular coats. A true fungoid enteritis follows, and the proliferation and thickening of the intestinal walls cause stenosis. T. Tuffier (*La Presse Méd.*, Feb. 21, 1900).

OBSTRUCTION DUE TO INTESTINAL PARESIS.—Functional obstruction usually results from previous inflammatory disorders or may be due to paresis after rough handling of the intestines during an intra-abdominal operation. Peristalsis is often absent; there is but little or no pain. The course of the case is that of a case of fæcal impaction, though the acute symptoms may develop much more slowly and be less severe.

OBSTRUCTION BY FOREIGN BODIES AND CONCRETIONS.—The history of the case

alone affords valuable information, the symptoms varying greatly. It is only when a sufficiently large foreign body becomes firmly impacted to excite tumefaction in the intestinal tissues that it gives rise to symptoms of acute obstruction similar to those defined. In obstruction due to gall-stones there is a history of hepatic colic and jaundice in a small proportion of cases. The pain and vomiting occur early, the latter being severe from the start, and becoming stercoraceous in the majority of cases. A tumor being rarely detected, the differential diagnosis is difficult.

The diagnosis *from other disorders* must be established. Most prominent among these are colic, acute enteritis, acute generalized peritonitis, and acute hæmorrhagic pancreatitis.

When, in a doubtful case, it is decided to open the abdomen in order to seek for a supposed mechanical obstruction, the writer recommends the following procedures:—

Open in the middle line below the umbilicus, because most of the causes of obstruction will be found in the lower half of the abdomen. Without allowing any intestine to escape, examine first with two or more fingers, or even the whole hand, the right iliac region, and pass from there toward the umbilicus to feel whether there are any adhesions there. It is in this right lower half of the abdomen that most of the causes of obstruction are to be found, for here are (1) the appendix; (2) intestinal diverticula, perhaps attached to the umbilicus or to the neighboring mesentery; (3) the commonest site for volvulus, that is, the cæcum; (4) the usual site for the lodgment of an impacted gall-stone, that is, the lower part of the ileum; (5) a common place for adhesions due to caseous mesenteric glands; (6) the sites of inguinal, femoral, and obturator hernia. Further, if the obstruction be in the small intestine, it is in the right iliac fossa that the undistended intestine will be found, and if

this can be secured and traced upward it is the surest guide to the seat of obstruction.

Examine next the left iliac region and the pelvic region, the latter especially if the patient be a woman, for there, as additional causes of adhesions, may be inflamed ovaries or tubes or some uterine trouble, with neighboring inflammation.

If no cause can be discovered then either open a coil of distended intestine and suture it to the skin, if the patient be too ill to bear more; or else decide to take the distended bowel out of the abdomen altogether, and if necessary open it, empty it, and suture it. It is only by so doing that you will be able to return it once you have decided to let it escape, and it is often only by so doing that you will find a deeply-seated obstruction.

These rules were elaborated for the writer's own guidance, and he has found that it is of great assistance to have some definite plan on which to proceed. If one has been able to eliminate the various conditions that simulate intestinal obstruction, it is evident that the next step is to have some clear idea as to how best to proceed in dealing with any mechanical obstruction itself. Anthony Bowlby (*British Medical Journal*, Jan. 3, 1903).

COLIC.—The abdominal pain usually termed "colic" is often associated with the temporary retention of fæcal matter in any part of the intestine or any local irritation, but the spasmodic character of the pain, its broad distribution from side to side, and the absence of any localized spot of sensitiveness usually facilitate recognition of the condition present. The prompt relief obtained from remedial measures, the response to purgatives, and the general history of the case usually place the diagnosis on a solid footing. Vomiting and collapse may also attend cases of cholera morbus, but fæcal vomiting only occurs in obstruction.

ACUTE ENTERITIS.—Irritant poisons also give rise to symptoms simulating intestinal obstruction, but we have the history, the probable presence in the vomitus of the toxic agent ingested, or of food liable to assume poisonous properties. As a rule, there is also violent diarrhœa, possibly tinged with blood; raised temperature; intense pain, located, not only in the abdomen, but also in the stomach, and generally referred to the "pit" over this organ—all characteristic signs. Though the later stages of a case of acute enteritis may be attended by collapse and other symptoms of obstruction, fæcal vomiting is always absent.

ACUTE HÆMORRHAGIC PANCREATITIS.—This condition is attended by symptoms closely simulating those of acute intestinal obstruction. In the early stages the true nature of the trouble present can scarcely be established without an exploratory laparotomy. Fæcal vomiting has not been observed in any case of acute hæmorrhagic pancreatitis so far observed.

ACUTE GENERALIZED PERITONITIS.—In this condition the chief distinctive features are an early rise of temperature, the history, and the general tympany and abdominal tenderness. There is a history of appendicitis, ulcer, traumatism, or some condition capable of leading to peritonitis, attended by an early and marked rise of temperature. The pain is not localized and the abdominal wall is so tender that the weight of the sheets even causes severe suffering. The abdomen is greatly and generally distended, and peristaltic action cannot therefore be discerned. The later stages of the cases also differ: collapse comes on later, while fæcal vomiting is never observed.

Etiology and Pathology.—Though the term "obstruction" is usually in-

cluded in the list of diseases, it is obviously not an affection, but a mere general appellation indicating the general etiological factor. The causes, nature, and the lesions attending the various forms of obstruction are, therefore, to be reviewed under this head.

STRANGULATION.—Of all the varieties of obstruction, this is the most frequent, representing, as it does, fully one-third of the cases classified. Strangulation occurs as the result of adhesions in over 60 per cent. of cases, the bands being due, in the majority, to previous attacks of peritonitis, to various causes, or to any other local inflammatory process entangling, compressing, or surrounding the loop of intestine involved.

Strangulation may also be the result of an anomalous union between the end of Meckel's diverticulum and the abdominal wall or the mesentery, a loop being thus formed into which a portion of intestine may become engaged and strangulated. The tip of the vermiform appendix may also, in the same manner, become the source of strangulation. Slits in the omentum or mesentery, or peritoneal openings or diverticula, adventitious or normal, the foramen of Winslow, the duodeno-jejunal fossa, openings in the diaphragm, etc., represent as many traps into which a loop of intestine may become caught and strangulated.

The small intestine is involved in 90 per cent. of the cases; and the obstruction occurs, according to Osler, in the right iliac fossa in 67 per cent. of the cases and in the lower abdomen in 83 per cent. Seventy per cent. of the cases occur in males, and 40 per cent. of all cases occur between the ages of 15 and 30 years.

INTUSSUSCEPTION.—Intussusception, or invagination of one portion of in-

testine into another portion of the same, is mainly due to irregular peristalsis, resulting, in turn, either from constipation, diarrhœa, colic, or paralysis. Nearly 40 per cent. of the cases occur in children. In a series of 500 fatal cases from some form of intestinal obstruction, Brinton found that 215 were due to invagination. In 103 cases collected from literature Wiggin noted that 50 per cent. occurred during the fourth, fifth, and sixth months in equal proportions, 75 per cent. of the patients being males. All but 12 cases were of the ileo-cæcal variety. In this variety the ileo-cæcal valve becomes invaginated into the colon, its much larger continuation, and may thus reach down to the anus, as witnessed in a case reported by Lange. The other varieties, met with in about 10 per cent. of all cases, are the ileo-colic, in which the lower portion of the ileum passes through the ileo-cæcal valve; the ileal, in which the ileum is alone the seat of invagination; the colic, in which the colon is alone involved; and the colico-rectal, in which the colon is invaginated into the rectum.

Intussusception with the passage of a portion of the intestines twenty-nine inches long on the fifteenth day, witnessed in a woman aged 56 years. Editorial (*Edinburgh Med. Jour.*, Apr., '88).

Sixty-four cases of intussusception observed in children within a period of twenty-one years; the majority—46 cases—were boys. The age at which the trouble occurred most frequently was from the third to the ninth month, more than one-half the cases occurring at this period. Among the 46 infants under 1 year, 39 were exclusively breast-fed. Only 2 were bottle-fed from birth. Hirschsprung (*Jahrbuch f. Kinderh. u. phys. Erzie.*, B. 39, H. 4, '95).

Intussusception is the cause of fully 30 per cent. of all cases of acute obstruction. The greatest proportion of cases of intussusception, fully 50 per cent., occur in children under ten years of age,

and of these more than 50 per cent. occur in infants under twelve months. Between the ages of five and forty to fifty the number of cases diminish, and after forty or fifty the frequency of occurrence is again noted. This condition may be explained upon the grounds of periods of debility, occurring in infancy and extreme adult age. J. F. Erdmann (*Med. News*, Dec. 24, '98).

Careful search made through the records of the Children's Infirmary of Liverpool, and it was found that out of 130,000 new patients there were only 16 cases of intussusception. Of these 16 cases only 7 recovered. The age at which intussusception usually occurs is somewhere between the fourth and sixth months of life. Murray (*Liverpool Medico-Chir. Jour.*, Jan., '99).

According to Nothnagel, invagination, or intussusception, is brought about by contraction of the longitudinal muscular fibres of the portion of intestine that overrides or receives the upper portion within itself, the irregular peristalsis of the invaginated portion assisting. Thus telescoped, the two lengths of intestine form a cylindrical mass varying in length up to two feet or even more. Three layers of intestine are thus superposed: the external (intussusciens), or receiving layer, acting as sheath for the invaginated portion; the middle layer, and the internal (intussusceptum) layer.

By application of a ligature to the intestines of an animal it was found that if it be applied sufficiently tight to cause complete obstruction, violent peristalsis is caused above the seat of ligation, but that no antiperistalsis is produced. Fæcal vomiting is accounted for by the fact that in the direction of the stomach least resistance is encountered. Nothnagel (*N. Y. Med. Jour.*, Apr. 13, '89).

The evidence derived from anatomical, physiological, pathological, and clinical *data* renders it legitimate to assert that spontaneous ileo-cæcal intussusception occurs when the colon is considerably larger than the ileum, and is so unduly

movable that it readily allows itself to become invaginated when once the process has begun. This variety of intussusception is essentially an affection of childhood, and such an undue increase in the width of the colon implies either a congenital abnormality or an unduly rapid growth, for at birth the diameter of the large intestine is practically the same as that of the ileum.

The physiological factor is much less easy to specify than the anatomical, for it is almost certainly an individual peculiarity. It may be stated broadly, however, that, as regards the ileo-cæcal portion of the intestine, the increased mobility, coupled with the unduly rapid growth in the width of the large intestine, is probably associated with increased and irregular peristaltic movements of the large intestine. D'Arcy Power (Brit. Med. Jour., Feb. 13, '97).

The main etiological factors of external origin are blows upon the abdomen, violent muscular movements, sudden or repeated jars of the body as in jumping, and particularly the violent jolting which infants sometimes receive when too violently handled.

In 103 cases of infantile intussusception nearly 50 per cent. occurred during the fourth, fifth, and sixth months, in nearly equal proportions; 75.4 per cent. of the cases occurred in males, and 89 per cent. were of the ileo-cæcal variety. Pritchard called attention to the probable part played by external violence in the causation of this disorder during early life, particularly the careless manner in which infants are picked up and doubled over the arm of those caring for them, thereby injuring and causing a temporary paralysis of some portion of the intestinal canal. Jacobi has also called attention to this matter, particularly to the way in which infants are violently jumped up and down to quiet their cry. Frederick Holme Wiggin (Med. Record, Jan. 18, '96).

Intestinal tumors may act as causative agents by dragging the portion of intestine to which they are attached into the adjoining portion.

Example of the causation of intussusception by polypus within the intestines. Van Bibber (Maryland Med. Jour., Dec. 31, '87).

In one case the principal cause of obstruction was found, after death, to have been due to a polypoid growth of the small intestine. C. McBurney (N. Y. Med. Jour., Mar. 28, '91).

Sodium bicarbonate causes contraction of the circular fibres of the intestine. Peristalsis continuing, invagination produced, thus showing one class of intussusceptions. R. T. Morris (N. Y. Med. Jour., Feb. 23, '95).

The post-mortem findings depend upon the duration of the intussusception. When death occurs early in the course of the attack but little change is observed. When the case has progressed some time, besides the invaginated portion of gut there may be localized peritonitis and, as a result of the circulation of blood by the tension and compression of the mesentery, more or less marked inflammation, extending to necrosis and sloughing of the tissues involved in the invagination. At first but little lymph is thrown out between the layers of gut in contact, and they may be easily disengaged; but, when the inflammatory process progresses some time, the surfaces adhere and cannot be separated. The only chance for the patient then is that the invaginated portion slough off, union occurring between the upper edge of the external layer and the free end of the intestine immediately above the invagination. This not infrequently occurs, the detached portion of gut being voided *per anum*.

VOLVULUS.—Twists and knots (volvulus) are more rarely met with than the forms just described: in about 12 per cent. of all cases of intestinal obstruction, according to Fitz's statistics. Volvulus generally occurs in adults between the ages of 30 and 50 years, and

more frequently in males than females. It is usually associated with abnormal length of the intestine involved and a lax mesentery. In children this elongation of the mesentery is always congenital (Keen). In adults, on the contrary, it is usually acquired, and arises in chronic constipation, from the weight of large masses of fæces, which pull down and drag upon the mesentery, thus causing its relaxation and elongation. In a case reported by Pillard, for instance, the sigmoid flexure was as large as the entire colon: a phenomenon frequently present, doubtless, since one-half the cases of volvulus reported suffered from lesions in this location. Next in frequency is the cæcum. A twist in the long axis of the gut is usually observed, but the intestine may be sharply bent upon itself, a loop may become twisted around another portion, or a knot be formed. Several causes of obstruction may be simultaneously present, as in a case witnessed by Bérard, in which a twist, a knot, and a constricting band were revealed by laparotomy.

Interesting case of a woman, 59 years old, in whom the use of the corset had brought about complete division of the right lobe of the liver, the inferior portion, nearly six centimetres in length, being united to that organ merely by a band of fibrous tissue, and pushed upward. The gall-bladder was united to the moving fragment, and fixed to the colon by adhesions of peritoneum. In consequence of these lesions the transverse colon was drawn up, and the traction thus exerted had induced a twisting of the intestines and an obstruction of the intra-intestinal circulation; the accumulation of fæces and gas beyond that fold had completed the occlusion. Bonuzzi (*Revista Ven. di Sci. Med.*, Jan., '92).

Purely mechanical twist may give rise to symptoms without paralysis of twisted portions. Pseudostrangulation may supervene after reposition of gan-

grenous loop and peritoneal infection follow. Great prostration and high pulse are indications of the latter. Nicolaysen (*Norsk Mag. f. Laeg.*, June, '95).

FOREIGN BODIES.—Intestinal obstruction seldom occurs as a result of impacted bodies, though many of these are accidentally swallowed. Many cases have been reported in which pointed metallic bodies even (Tily, Reverdin, Fourneaux, and others) were ingested and voided without accident. Occasionally, however, an object becomes impacted in the intestinal tract and may give rise to symptoms of intestinal obstruction in any region, even when near the anal orifice.

Lunatics are especially prone to ingest articles of various kinds,—nails, pins, needles, hair, etc.,—and obstruction from this cause is therefore comparatively frequent in these subjects. In ordinary life, however, obstruction is more frequently due to the ingestion of large objects, artificial teeth, buckles, opened safety-pins, etc. Intestinal obstruction is occasionally caused by large quantities of seeds, "blackberry-time" thus being the source of an occasional case. Lumbricoid worms may also form a tangled mass and obstruct the intestinal lumen. (See also **ŒSOPHAGUS, FOREIGN BODIES IN.**)

Case of a woman, 47 years of age, who was operated on for acute intestinal obstruction. When the abdomen was opened, no occlusion of the gut was found, but while the patient was recovering from the anæsthesia she vomited several ascarides. Later, flatus and fæces passed normally. It is likely that the worms began to move from the gut in consequence of the pressure upon the intestine exerted during the operation. Schulhof (*Münch. med. Wochen.*, June 16, 1903).

GALL-STONES AND ENTEROLITHS.—Cases of intestinal gall-stone occlusion are comparatively rare considering the

frequency of cholelithiasis. They are also infrequent as compared to other forms of obstruction, Leichtenstein having found but 41 cases among 1541 cases of intestinal obstruction from various causes. It is usually observed after the fiftieth year. Eighty per cent. of the cases reported occurred in women after the fiftieth year. The impaction always occurs in the small intestine, in the neighborhood of the ileo-cæcal valve, and occasionally in the duodenum. The impacted mass may consist of but one calculus or of a large number. They penetrate the intestinal wall through an opening created by pressure-ulceration, involving the gall-bladder and the intestine affected.

Enteroliths are rarely observed in the human species. They are mainly composed of phosphate of lime and magnesia, and develop around a nucleus of hardened fæces, a gall-stone, or a small foreign body. Magnesia and bismuth taken as remedies in large quantities occasionally form enteroliths; these are usually light and porous. Masses of hair, or quantities of oatmeal (avenoliths), starch, and other *Graminaceæ* may thus become foci for enteroliths.

FÆCAL OBSTRUCTION.—This form of obstruction occurs at any age, but particularly in the aged and in children, as a result, doubtless, of impaired tonicity of the muscular coat of the intestine affected: usually the colon or rectum. The colon may become, as a result of the accumulation of fæcal matter and gas, enormously enlarged. This is commonly channeled, small amounts of fæces passing until the complete occlusion occurs. In acute cases the wall of the distended gut is extremely thin, but in chronic cases, those in which the lumen has become very gradually narrowed or characterized by prolonged periods of constipa-

tion, compensatory hypertrophy occurs in its muscular layer. Rupture occasionally occurs, especially when ulceration of the mucous membrane is caused by the pressure of the contents.

POST-OPERATIVE OBSTRUCTION.—Intestinal obstruction following operation is caused, according to Deaver, either by paresis, the result of traumatism or sepsis, or a combination of these, or to mechanical causes. About 2 per cent. of deaths following abdominal section are due to mechanical or true intestinal obstruction. The most important form occurs when the intestine becomes adherent to a fixed surface which has been denuded of peritoneum. As a result of the adhesion the bowel becomes kinked and immobile. Obstruction may also occur as a result of adhesion of the bowel to neighboring coils of intestine; here another factor usually comes into play: bending of the bowel over the brim of the pelvis or over the omentum whose free edge has become attached. Still another variety occurs from bands of adhesions running from one place to another, under which a knuckle of gut slips and becomes fixed. A variety of purely mechanical obstruction and one that should never occur arises from including a portion of the bowel in a ligature. A knuckle of gut slipping through a hole in the omentum may also give rise to obstruction of the bowel as a result of abdominal operation.

The statistics of Spencer Wells and Fritsch both give about 1 per cent. of intestinal obstruction as the proportion after ovariectomy. The writer comments on fifty-seven cases which he has been able to collect, and finds that twenty-seven of them followed ovariectomy, and apparently as often after simple cases as after the more complicated ones. The symptoms of obstruction supervened either early in the case—*i.e.*, within ten or fifteen days, and most frequently from

the third to the fifth—or they were postponed to a much later date, such as months or years subsequently. F. Legueu (*Gaz. des Hôp.*, Nov. 23, '95).

It is estimated that from 1 to 2 per cent. of deaths after laparotomy occur from intestinal obstruction.

Many cases diagnosed as sepsis are primarily obstruction.

The symptoms of post-operative obstruction are vomiting first of undigested food and fluids, later of a bilious character, and finally stercoraceous; shock and inability to pass fæces, or flatus; but, if the obstruction be high up, passages from below the obstructed point may be discharged. Hugh M. Taylor (*Va. Med. Monthly*, Jan., '96).

Seven cases of intestinal obstruction following laparotomy seen, five of which were fatal. The obstruction always occurs in the small intestine near the seat of the operation, and most frequently quite near the junction of the small and large intestines.

There are no clear-cut, positive symptoms. There is a wide difference in the symptoms from those which indicate the usual acute intestinal obstruction. In none of the cases was the integrity of the intestine involved; probably the operation had so lowered the vital forces that paralysis of the bowel took place, peristalsis ceased, and septic poisoning occurred through accumulation of the secretions of the bowel. The main symptoms in these cases are persistent vomiting, which is of much more significance when it comes on several hours after the operation and is not due to the anæsthetic; pain, which might be local or general, and frequently is not severe. The temperature is not usually marked, but the pulse is rapid and there is a peculiar, anxious expression of countenance which is quite characteristic. H. O. Marcy (*Med. Rec.*, May 23, '96).

Post-operative intestinal obstruction is due to tonic muscular spasm, to true intestinal paralysis, to the formation of new adhesions, or to pre-existing constriction not discovered or relieved at the time of operation. Boise (*Med. News*, July 18, '96).

The possibility of post-operative ob-

struction should be borne in mind in all abdominal operations, especially in conditions likely to result in extensive adhesions, *e.g.*, appendicitis with peritonitis; pyosalpingitis with pelvic peritonitis. All raw surfaces should be covered as much as possible with normal peritoneum, or, where this is not practicable, perhaps with cargile membrane, or carefully arranged omentum. Small incisions and the least possible manipulation and evisceration should be the rule. The cleansing of the peritoneum should be done rapidly and with the least possible trauma and handling of normal peritoneum. Flushing with hot saline solution is advisable where there is much foreign material to be removed. The smallest possible drains should be used if any; cigarette drains are preferable to gauze, as they are less irritating to the surrounding peritoneum; cases of pyosalpingitis or pelvic peritonitis rarely require drainage, and, when necessary, drainage through the *cul-de-sac* can usually be employed. Diet and regulation of the bowels should be watched with the greatest care during the first few weeks of convalescence; attacks of gaseous indigestion with colicky pain should be regarded with suspicion and treated promptly and vigorously. Determined effort should be made to relieve early attacks of obstruction by enemata, position, gastric lavage, etc., and if successful, patient should be kept on a scanty fluid diet for some time and watched most carefully for possible recurrence of symptoms. If palliative measures are unsuccessful after a few hours' trial, operation should be promptly resorted to. In cases occurring later than four to six weeks, palliative measures are less likely to be effective, and early operation is usually imperative. All patients who have been operated upon for intra-abdominal inflammatory troubles should be warned of the possibility of the occurrence of obstruction before leaving the care of the surgeon, impressed with the importance of avoiding indiscretions in diet and attacks of indigestion, and of seeking advice promptly if such attacks should occur. The operative procedure must be adapted

to each individual case; the right Kammerer incision for cases following appendicitis with complete healing is often useful; the median incision, as a rule, for other conditions. Resection and end-to-end anastomosis should be preferred to enterostomy in the majority of cases where gangrene or sloughing of the gut wall demands one or the other. Peck (*Annals of Surgery*, Oct., 1904).

Treatment.—Whatever measure is resorted to for the relief of acute intestinal obstruction must be used promptly, but of equal importance is the avoidance of remedies which, though seemingly indicated, are hurtful. Among these may be classed purgatives. The most active factor in the production of suffering is exaggerated peristalsis; to administer drastic purgatives, etc., but accentuates the torture of the patient, exposes him to early collapse, and increases the chances of rupture. Especially is this a fact when some foreign substance—such as a pin, needle, etc.—has been swallowed. Under such circumstances, the patient must be given food which will have much solid residuum, such as oatmeal, cornmeal, or large quantities of bananas or mashed potatoes. The latter is especially useful when sharp bodies have been swallowed. The prolonged constipation preceding the acute attack has usually caused the patient to resort to various measures, which, though ineffectual as purgatives, have already induced partial exhaustion of the intestinal muscular fibres.

Extreme caution is necessary in the administration of laxatives when an obstruction of the intestine may be the cause of the symptoms. If the bowels are not moved, an attempt at purgation makes the patient much worse, and too often induces a state of collapse, which renders an operation hopeless; or, if an operation be performed, the bowel is found so distended and paralyzed that it cannot recover its tone. C. P. Gildersleeve (*Med. News*, Mar. 26, '98).

Purgatives are absolutely contra-indicated in all cases of acute obstruction, and are of very limited, exceptional, and temporary advantage in chronic cases. T. F. Prewitt (*Jour. Amer. Med. Assoc.*, Apr. 23, '98).

Physostigmine in doses of from $\frac{1}{120}$ to $\frac{1}{80}$ grain (0.0005 to 0.00075 gramme) for tympanites in different intestinal disorders has given excellent results. The drug is given by mouth three times daily. Von Noorden (*Berliner klin. Wochen.*, Oct. 21, 1901).

The use of opiates tends, likewise, to reduce the vital activity of the intestinal tissues; morphine should only be used, therefore, when there is severe pain, and just enough should be administered hypodermically to assuage the suffering.

Attention called to harmful effect of opium in intestinal obstruction. In case of acute intestinal obstruction, in a vigorous boy of 19 years, due to a fibrous band, the abdomen was opened, the band divided, and the patient did well until the fourth day, when, suddenly, vomiting and symptoms of obstruction reappeared. Wound was perfectly healthy. In searching for cause of symptoms it was found that patient had received about 5 grains of opium during the four days after operation, contrary to instructions. Castor-oil was administered, in drachm doses every half-hour, until bowels were moved, when symptoms disappeared and the patient again entered on convalescence. Thierry (*Bull. de la Soc. Anat.*, Oct., '92).

The distressing vomiting first claims attention. The most satisfactory measure is lavage of the stomach. Not only is the vomiting relieved, but all other symptoms, including undue peristalsis, seem to be reduced in intensity, and the patient is advantageously prepared for operative procedures should such become necessary. Practiced repeatedly,—*i.e.*, every three or four hours,—this measure has alone proved curative in some cases.

The most effective methods for the

reduction of the obstruction are the use of large water enemata and the insufflation of air. The former is to be preferred; the quantity of liquid used can easily be gauged, while the pressure can conveniently be regulated by raising or lowering the vessel from which the fluid is obtained. As noted by Jeffreys Wood, before attempting to reduce an intussusception with water sufficient assistance must be secured. The child is, of necessity, exposed a great deal during the treatment; so that a hot-water bag to lie on, with cotton-wadding coverings over the legs, are necessary to prevent too much shock. The height at which the funnel or irrigator is held is about four feet. An ordinary red-rubber tube one-half to five-eighths inch in diameter, as used for washing out the stomach, may be used.

Among medical measures which may be instituted as precursory to surgical intervention in the event of failure high rectal enemata head the list. These should always be given with the patient in the knee-chest position; but, if the patient is too weak to assume this posture, a left or right lateral semiprone position will answer. The enemata should be carried by means of a long, flexible rectal tube as high up as one can succeed in introducing it. Plain, warm water; or water and glycerin; or water to which a modicum of turpentine has been added, the turpentine being emulsified by shaking up with an egg, may be used. If three or four enemata do not yield results, it is unwise to delay coeliotomy. It is risky to administer purgatives.

Opiates should be withheld as part of the medical treatment; they should only be given during the time consumed in preparing for operation, to obtund the pain. In the event of failure with the enemata, all observers are agreed that early operation offers the only salvation for the patient. Murphy operates early; McArdle advocates early operation; Broca operates after twenty-four hours;

Naunyn also urges early operation and holds that the best results are obtained in the first three days. L. A. Hering (N. Y. Med. Jour., Feb. 9, 1901).

Experienced clinicians usually recommend preliminary anæsthesia, but in many cases the state of the patient does not warrant this proceeding: an advantageous one in every way when it can be adopted. D'Arcy Power places the patient under chloroform and steadily fills his intestine with hot salt solution under an hydrostatic pressure of not more than 3 feet in a child, the fluid being allowed to remain in the intestine at least 10 minutes. The inclined posture or the genu-pectoral position may be used, but complete inversion is better. By inverting the patient, the fluid not only reaches farther, but the traction induced by the weight of the invaginated portion of the intestine tends to disengage it. Jonathan Hutchinson further assists the above measure by thoroughly kneading the abdomen and violent shaking of the patient, the latter being held in the inverted position by several persons. Plain warm water is used by some, warm olive-oil by others.

While the liquid is being introduced, the physician's hand should assist by gentle taxis the liberation of the invaginated or obstructed gut. Manning states that in reducing an intussusception traction from above the mass should never be employed; for, should the parts be gangrenous, slight traction may suffice to rend them and allow the intestinal contents to pass into the peritoneal cavity. Pressure on the apex of the mass in the direction opposite to that which it formed will reduce it with the least danger.

The patient does not lie quietly in bed during the early hours of the disease, but is constantly tossing and moaning and continues doing so until the gut is reduced or until gangrene and sepsis are

established. If after an injection the restlessness and moaning cease, — *i.e.*, during the first twenty-four to forty-eight hours,—it can be safely stated that reduction has taken place. J. T. Erdmann (Med. News, Dec. 24, '98).

Cases successfully treated with quicksilver. In a man of 60 years operation was refused, and $\frac{1}{2}$ pound of mercury was administered on the ninth day. In the second case, a man of 80 years, operation was considered inadvisable because of the patient's age, and the same dose of quicksilver was given on the third day. The symptoms were typical in each case, and were promptly relieved by the mercury. In neither instance did the drug produce an increase of abdominal pain, nor were there any other symptoms of mercurialism. J. McK. Harrison (Brit. Med. Jour., April 26, 1902).

Enemata are seldom successful after the first forty-eight hours, every hour saved up to the end of that period increasing the chances of complete reduction of the obstruction. Again, the likelihood of success is far greater when the obstruction is located in the colon.

When enemata prove unsuccessful, insufflation of air should be tried. This, however, offers greater danger of rupture owing to the fact that the quantity of air used cannot be carefully gauged. On the other hand, air penetrates more readily the ileo-cæcal valve and may thus be more effective than water when the obstruction is situated in the small intestine. Carbonic dioxide has also been used for the purpose, but is inferior to air.

In intussusception in children distending the bowel by inflation of air is a better and safer method of reducing the invagination by mechanical means than the distension of the bowel by water. The child should be clothed in a jacket of wool, and the legs and arms covered with wool and bandaged. It is then anæsthetized, and an ordinary enema-pipe introduced into the rectum. This

pipe is connected by means of a piece of India-rubber tubing to a pair of common bellows, or, if it is at hand, a Lund inflator. The outside of the tube around the anus is carefully packed with wool, which is held in position by an assistant, so as to prevent the escape of air by the side of the tube. The child is now inverted and held by a nurse, while the bellows are slowly and steadily worked by an assistant. The surgeon should have his hand placed on the abdomen of the child so that he can feel the tumor. As the intestine is inflated he will gradually feel the colon becoming distended, and he can regulate the amount of air introduced and stop it as soon as he feels the colon is distended as far as is safe. If the plan succeeds and the invagination is reduced he will suddenly feel the tumor disappear from under his hand, and the air will become diffused over the whole abdomen, so that what was at first distension of the colon is now a uniform distension of the abdomen. More importance attached to this sign than to the sudden disappearance of the tumor as an indication that the intussusception has been reduced.

Treatment by operation is a very severe proceeding in infants and quite young children, and is often followed by death.

In 64 cases of laparotomy undertaken for the relief of intussusception in infants under one year of age, 21 recovered and 43 died. Pickering Pick (Quarterly Med. Jour., Jan., '97).

In intussusception, distension of the bowel with gentle external manipulation should be tried in recent acute cases, the surgeon being present and prepared to operate at once if these means fail. Inflation may be contra-indicated by the severity of the symptoms or their chronicity. Great care should be taken that the reduction of the intussusception is complete; thickening about the ileo-cæcal valve may simulate incomplete reduction, so that when in doubt the part should be examined through an incision in the bowel. Any attempt to fix the bowel after reduction by sutures seems to be contra-indicated. Small doses of opium should be given after

operation. When reduction is impossible, resection through an incision in the colon seems to give the best chance, the junction between the large and small bowel being made secure before any part is cut away. D'Arcy Power (Jour. Path. and Bact., June, '97).

Inflation should be tried only when the case is seen within a few hours of onset and is not of a very acute character. In the great majority of hospital cases it is better to open the abdomen at once. Inflation may also be tried in certain other cases for the purpose of reducing the main portion of the intussusception and enabling the incision to be made directly over the cæcum. When reduction is found impossible in chronic cases a resection may be generally done through an incision in the inshcathing bowel. In acute cases, and especially if gangrene is present or the condition of the bowel requires its removal, a wide resection should be undertaken as rapidly as possible, and the ends brought outside the abdomen; continuity should be restored at a subsequent operation. In exceptional cases of enteric intussusception resection and immediate restoration of continuity gives the only chance. Bernard Pitts (Brit. Med. Jour., Sept. 7, 1901).

Out of 33 cases of intussusception treated by enemata or inflation, recorded by Fitz, 22 were saved. Wiggin collected 39 cases of the same kind in 23 of which these measures proved successful. Recurrence is apt to occur in intussusception, however. This is ascribed by Frederic Eve in the large class of ileo-cæcal intussusceptions to the ileo-cæcal orifice still remaining slightly invaginated into the cæcum.

In intestinal obstruction *following laparotomy* H. O. Marcy states that injections are of no use. A careful examination of the intestine should be made at the site of the operation, then in the region of the appendix, and then of the omentum, and the obstruction will usually be found. If this is done

early the difficulty can be corrected. In desperate cases an incision may be made in the abdomen; the first inflated coil of intestine seized, attached to the wound, and opened, establishing an artificial anus; and thus the patient is carried along until a thorough and radical operation can be performed. As a prevention of this complication he believes that careful suturing of every abrasion of the peritoneum is of great value.

The tympanites, besides adding to the suffering, sometimes prevents the expulsive effort of the intestine, by totally arresting peristaltic action. The chances of reduction are greatly increased in some cases by elimination of the intestinal gases. Sweetnam reduces tympanites by posture. In very extreme distension he recommends the knee-chest position, but in cases of moderate distension he places the patient upon the side and elevates the foot of the bed. It may be necessary to keep the hips in the elevated position for ten or fifteen minutes before the contents of the abdominal cavity gravitate sufficiently from the pelvis to enable the upper portion of the rectum to pass out of the pelvis toward the abdominal cavity.

Relief will not be secured until this occurs. In marked tympanites the distension is practically confined to the large intestine, and obstruction to the escape of flatus is due to the downward pressure of the descending colon and sigmoid flexure upon the upper portion of the rectum, forcing the folds of Houston one upon the other and bringing about, for the time being, an impermeable stricture. An attempt to pass this by the soft-rubber tube will fail, because the tube will coil upon itself. Turpentine stupes and hot applications are excellent adjuvants.

When tympanites is extreme and can-

not be relieved by the means indicated, puncture of the gut through the abdominal wall is recommended by some authorities. A small aspirator-needle thoroughly *asepticized* should be used and left *in situ* until collapse of the gut is manifest.

The use of electricity in addition to the mechanical action of water is advocated by Mingour and Bergonié. A 2-per-cent. salt solution may be used, the positive pole of a galvanic battery being placed on the abdomen and the negative in the rectum.

The use of atropine in large doses, $\frac{1}{12}$ grain hypodermically, recommended in intestinal obstruction before deciding on laparotomy. Two cases, one due to paralysis, the other to spastic contraction of the muscular coats, were relieved by the drug alone; in a third coeliotomy became necessary, the intestinal obstruction being due to a parametritic band. Batsch (Münch. med. Woch., July 3, 1900).

In illustration of the beneficent action of atropine in intestinal occlusion, the writer describes a case of occlusion in which he used the remedy after all other measures had failed, and operation seemed inevitable. Four injections of atropine (1 minim) were given at short intervals; and after the fourth, the patient passed a quantity of gas from the bowels, vomiting ceased and shortly after, a considerable amount of faecal matter was passed, accompanied with severe colic. A second stool soon followed, and the patient's distress was entirely relieved. The writer urges the invariable essayal of this remedy in all such cases, as it is prompt in effect, and in the event of failure to relieve, surgical intervention is not too long postponed by its trial. V. Fabris (Gazz. Osped., Jan. 4, 1903).

If, after a short, but faithful, trial of the methods indicated, no satisfactory result is reached, the abdomen should be opened. Wiggin states that, as a preparatory treatment in operations for intestinal obstruction, the stomach

should be washed out, if there has been much vomiting or abdominal distension, while an intravenous saline injection of three pints will be useful if the patient is suffering from shock. If the site of the obstruction is not located, he recommends that the incision be made through the right rectus, between the umbilicus and pubis. If the intestinal coils be greatly distended, the distension should be relieved by aspiration or, if need be, incision. He states that in the after-treatment excessive thirst may be allayed by two or three large doses of bismuth subnitrate, and after the first day the patient may be made more comfortable if allowed to lie on his side. The general tendency is to give too small quantities of nourishment at too frequent intervals: a system which fatigues the stomach and is likely to cause irritability of the organ.

The fact, apparently demonstrated by statistics, that one-third of the cases recover as a result of internal treatment, is likely to lead to some disastrous results. Statistics tend to show that at least 4000 deaths occur in Germany in a year from intestinal obstruction. Even under the most favorable conditions, at least two-thirds of the cases depend exclusively upon surgical treatment. A. Schreiber (Deutsches Archiv f. klin. Med., Dec. 13, 1900).

In chronic cases—*i.e.*, when the symptoms are not strongly marked and the obstruction is shown to be incomplete by the occasional passage of small quantities of faecal matter, perhaps mucoid and tinged with blood—the possibility that intussusception is present and that the invaginated portion will slough off and bring about recovery should be borne in mind. Still, as correctly emphasized by Erdmann, these cases can never be claimed as true cures, owing to the likelihood of stricture-formation's following the sloughing process, and the fact that

they are very prone to be followed by obstruction, demanding at a later day an emergency operation, which is likely to have a more serious aspect than would the question of primary operation for intussusception.

Extensive experience with irrigations of hot saline solution has shown that the method is unreliable, and he is now a whole-hearted advocate of abdominal section at the earliest possible moment in every case of intussusception. Irrigation and inflation are such doubtful methods that valuable time is lost, and if the bowel has become at all stiffened by inflammation it is impossible to overcome the adhesions. So long as the bowel remains invaginated, even to the slightest extent, the intussusception may recur. With the rarest exceptions recovery from an intussusception only takes place when the invagination is capable of easy and simple reduction. Fifteen of 65 personal cases needed excision of part of the bowel before the intestinal obstruction could be overcome. Fourteen died and 1 recovered. In 10 cases excision was performed because the bowel was gangrenous; in 4 cases because the softened tissues tore during manipulation. In 6 of the 15 cases an artificial anus was made; in 5 cases a Murphy button was employed. Twice Maunsell's operation was performed, and once the intestine was united by a circular enterorrhaphy. D'Arcy Powers (*Clinical Journal*, Aug. 14, 1901).

The writer calls attention to the fact that too much stress has been hitherto laid on the mere removal of the mechanical stoppage and not enough on the evacuation of the putrid material which is killing the patient. The older method of emptying the bowel by colotomy is unsatisfactory, as the bowel is in a state of paresis or complete paralysis and expels its contents very slowly, so that until it is cleaned out the cause of this paralysis remains in great part. The best course in many of these cases, probably in all, that are still within the reach of any operative procedure, is to resect the tract of paralyzed and dis-

tended bowel at once. This does not apply to recent cases where the bowel is not seriously damaged by the retained feces, and is manifestly sound at and above the seat of obstruction. The author does not establish drainage in most cases, but closes the abdomen at once, unless there be general peritonitis, having a great belief in the power of the peritoneum to take care of itself. The after-treatment is of extreme importance. Patients in all instances sit up in bed from the first as much as possible, and only lie down for sleep, so as to overcome the tendency to hypostatic pneumonia. They should begin at once to take a mixture of 10 grains of carbonate of bismuth three times daily, which the author believes to be the best intestinal antiseptic. Albumin water, with 1 drachm of brandy, should be given from the first, by mouth, in small quantities, and nutrient enemata and instillation under the skin of normal saline solution or 5 per cent. solution of glucose is recommended as a routine procedure. Half a litre morning and evening may be given, if necessary. It is not well to check a diarrhoea, as this material must be evacuated before the patient is safe. Bismuth cleanses the gut and so arrests the diarrhoea. Cold sponging and warm drinks will take care of the possible temperature. If the fever is due to pulmonary emboli or pyelphlebitis, the general strength should be sustained by the use of the usual stimulants. A. E. Barker (*Lancet*, Sept. 17, 1904).

Many cases are brought to the surgeon so late that the patient is exhausted. An extensive laparotomy is out of the question under these circumstances. Wharton advises a colostomy. The opening should be made in the sigmoid flexure, if it be certain that the obstruction be below that point, otherwise the abdomen should be incised in the right iliac region and the cæcum opened, if it be found distended.

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